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Boston Transit Commission

Twelfth and Thirteenth Annual Reports

June 30, 1906
June 30, 1907

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FROM

THE BOSTON TRANSIT COMMISSION,

15 Beacon Street,

GEORGE G. CROCKER, *Chairman,*

CHARLES H. DALTON, (to October 11, 1906.)	HORACE G. ALLEN,
THOMAS J. GARGAN,	JOSIAH QUINCY, (from October 11, 1906.)
GEORGE F. SWAIN,	*Commissioners.*

HOWARD A. CARSON,
Chief Engineer.

B. LEIGHTON BEAL,
Secretary.

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TWELFTH ANNUAL REPORT

OF THE

BOSTON TRANSIT COMMISSION,

FOR THE YEAR ENDING

JUNE 30, 1906.

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BOSTON TRANSIT COMMISSION.

15 Beacon Street, Boston, June 30, 1906.

To the City Council of the City of Boston:

In compliance with Statutes of 1894, chapter 548, section 24, the report of the Boston Transit Commission for the year ending June 30, 1906, is respectfully submitted.

Washington Street Tunnel.

Progress in the construction of the Washington street tunnel during the year has been satisfactory. At the date of the last report five sections, extending from the beginning of the southerly incline at a point about opposite Nassau street to a point near Court avenue, were under construction. These five sections have been substantially completed as follows:

Section 1	July 15, 1905.
" 2	Aug. 10, 1905.
" 3	Dec. 13, 1905.
" 4	Nov. 27, 1905.
" 5	Mar. 19, 1906.

All work, with the exception of that on Section 3, was completed in advance of the contract date. Technical details as to these sections will be found in the report of the Chief Engineer.

The construction of this part of the Commission's work has presented problems which were not encountered in the building of the Tremont street subway, and the work has been necessarily slow on account of the size and character of the buildings along the route, many of which it has been necessary to support during construction, or to underpin permanently. Up to date, ten structures on Section 1, seven structures on Section 2, five structures on Section 3, thirty-three structures on Section 4, thirteen structures on Section 5, eight structures on Section 8, and four structures on Section 9, eighty in all, have been underpinned.

Use of the Common.

A discussion arose in 1905 in regard to the use of a piece of the Common near Park square for a concrete mixing plant and for the storage of such supplies as must be available for immediate use. The last communication to His Honor the Mayor, dated April 6, 1905, concluded as follows:

> "The Commission assures Your Honor that it will sedulously guard the Common against permanent injury, and at the end of its occupation will cause the portion occupied to be left in good and suitable condition."

The contractor ceased his occupancy of the Common about January 1, 1906. In the opinion of the Commission he left it in at least as good condition as he found it.

Route from Adams Square—North.

The legislation of 1905 (Chapter 460) for the location of the route of the tunnel from Adams square north proved effective. The Boston Elevated Railway Company was desirous of using a portion of the present subway, from Adams square north for its elevated trains, without consenting to the construction of subways and trackage in substitution for the same. The Commission believed either that no part of the present subway in Washington street should be used for the traffic of the Washington street tunnel, or else that compensation should be made by new structures for any part so used. An adjustment of this difference of opinion was finally reached, and a plan was adopted Dec. 12, 1905, which apparently did not involve a cost much in excess of the cost of necessary alterations in the present subway, and which proved acceptable to the officials of the Boston Elevated Railway Company. It covers that portion of the route between the southerly side of Adams square and the northerly end of the Haymarket square platforms in the subway. The details of the plan will be found in the report of the Chief Engineer.

In making studies for this portion of the route it became apparent that it would be necessary for the Commissson to use, either at or below the surface, a portion of the land taken by eminent domain from the Boston & Maine Railroad in 1894, and subsequently transferred to the city of Boston, for which the Commission received $616,000. It was claimed by the Boston Elevated Railway Company that this property came within that clause of Section 6 of Chapter 534 of the Acts of 1902 which gave the Commission authority to ''use public ways and lands without compensation therefor.'' The Commission was of opinion that in equity, if not in law, the city was entitled to compensation. The advice of the Corporation Counsel was sought, and he gave an oral opinion that the term ''public ways and lands'' applied only to such property of the city as it could not dispose of by sale, such as Common, streets, parks, etc., but that it did not apply to any merchantable realty such as a school-house lot, land upon which public buildings are placed, and the realty in question. To this view the Company finally assented.

Plans for the construction of the tunnel from the end of Section 5 to Adams square have been delayed awaiting a settlement with the Trustees of the Ames Estate as to the method of protecting the Ames building. The remainder of the distance for which the route has been agreed upon, was covered by Sections 8 and 9.

Section 8 begins 150 feet north of State street and extends to Hanover street. It was contracted for March 12, 1906.

Section 9 begins at Hanover street and extends to Haymarket square. It was contracted for May 22, 1906.

Property Taken and Settlements for the Same.

As indicated on pages 9 and 10 of the Eleventh Annual Report, property on the south side of La Grange street was taken by eminent domain on September 26, 1905, in place of that previously taken on the north side. The first named property belonged to David H. Hayden et als. and Charles H. Dill, 2d. Settlement has been made with David H. Hayden et als. for their part of the property taken.

July 13, 1905, an easement was taken in the property at the corner of Washington street and Hayward place for the northerly entrance to and exit from the platform for the north bound cars, which platform extends from Essex street to Hayward place.

Easements were taken below the surface in the property on the east side of Washington street from Elm street to Hanover street, March 8, 1906, and from Hanover street to Haymarket square, May 15, 1906, for the route of the tunnel from Adams square north.

Although the locations are practically decided upon for the rest of the entrances and exits, no other takings have been made in order to save the interest on their cost until the Commission was ready to begin the actual work of construction.

Old State House.

The space in the Old State House occupied for an entrance to and exit from the East Boston tunnel will also be used for the same purposes in connection with the Washington street tunnel. It seemed to the Commission, however, that it was advisable to provide additional means of entrance and exit. One of the plans proposed to utilize the entrance now at the westerly end of the Old State House. This plan in no wise contemplated any alteration of the exterior of the building. The space to be occupied on the ground floor measured about 14′ x 8′. In building the East Boston tunnel a part of the ground floor had been made fireproof. It was the intention of the Commission to complete this work and fireproof the entire floor, thus adding largely to the stability and security of the structure.

The Commission believed that the annual income of 4½% upon the commercial valuation of the space taken, would amply compensate for the small loss of area in the premises; that the sentiment attaching to the venerable structure as an historic relic, highly valued by the Commonwealth and the City, would not be impaired; that its fire risk would be largely reduced; and that the many thousands of citizens who would use the passage in their daily transit from and to their homes would be better served than by any other plan.

Various patriotic societies, however, took an opposite view of the matter and freely agitated the subject by remonstrances addressed to the Commission, by letters to the daily press and by public meetings. The Governor of the Commonwealth and the Mayor of the City, having expressed to the Commission their belief that it was unwise to make any further use of the Old State House for traffic purposes, the Commission, on June 19, 1906, passed the following preamble and vote:

> "WHEREAS, His Excellency the Governor and His Honor the Mayor of the City of Boston have each expressed to this Commission the opinion that it is not expedient to use the Washington street doorway of the Old State House for an entrance to the Washington street tunnel,
>
> "VOTED, that that plan be stricken from the list of those under consideration."

Ventilation.

Especial attention is directed to that part of the report of the Chief Engineer describing the provisions for the ventilation of the Washington street tunnel, by which the air can be changed every twenty minutes, throughout its entire length—(provided the fans are properly installed and operated)—and the foul atmosphere, brought in by the cars, swept from the tunnel.

The system is the same, adapted to differing conditions, as that in the Tremont street subway and East Boston tunnel, where it has been successful.

Acknowledgment to the Public.

The Commission takes this opportunity to record its appreciation of the patience of the public in enduring and overcoming the many inconveniences made necessary during the progress of the work, and of the almost universal co-operation of the owners and occupants of estates on the line of the tunnel.

EAST BOSTON TUNNEL.

On November 21, 1905, the Boston Elevated Railway Company made its first payment of rental for the East Boston tunnel, said rental being on the basis of three-eights of one per cent. of the annual gross earnings of all lines owned, leased or operated by the Company. The period covered by this payment was from December 30, 1904, to September 30, 1905, and amounted to $35,398.22, indicating an annual payment for that year of about $47,000. The tolls collected to October 31, 1905, a month longer than that period, amounted to $85,551.20, and the cost of collection of the same to $13,635.19. Traffic for the full year, from January 31, 1905, to January 31, 1906, was 10,427,376. The average daily traffic was about 30,000, and the largest traffic for any one day was Sunday, January 1, 1905,—53,000, the tunnel having been opened two days previously.

The Atlantic avenue station was opened to the public on April 5, 1906.

Winthrop Statue.

The Commission has provided a new base for the Winthrop statue, removed from Scollay square, and it has been set up in the plot adjacent to the First Church, at the corner of Marlboro and Berkeley streets, the location having been approved by the Art Commission.

SUBWAY.

Payment of Rental under the Toll System.

In accordance with that clause of the lease of the subway which provides that if in any one quarter the amount which the Company would pay for rental, reckoned on a stated toll for each car, should exceed the amount reckoned on the basis of four and seven-eighths per cent. of the cost, the Company shall pay such excess, the following was received:

AUDITOR'S OFFICE.
101 MILK ST.

BOSTON, MASS., Oct. 26th, 1905.

MR. B. LEIGHTON BEAL, *Secy., Boston Transit Commission,* 20 *Beacon St., City.*

DEAR SIR:—I regret to be forced to report to you that this company is obliged to pay to the City of Boston $149.73 for additional rental of the subway for the quarter ending with September 30th, 1905, on account of the number of trips at 5c. each during that time, having exceeded the rental on the basis of $4\frac{7}{8}\%$ of the cost.

Very truly yours,
(Signed) H. L. WILSON,
Auditor.

The payments previously made amounted to $14,120.21 making a total of $14,269.94 thus far paid on account of the operation of the toll clause.

LEWIS AND CLARK EXPOSITION.

The exhibition of this Commission at the Lewis and Clark Exposition was awarded a "gold medal." In this connection the following letter is self explanatory:

BOARD OF MANAGERS FOR MASSACHUSETTS OF THE
LEWIS AND CLARK CENTENNIAL EXPOSITION
PORTLAND, OREGON, 1905.
27 SCHOOL ST., BOSTON.

December 12, 1905.

BOSTON TRANSIT COMMISSION, *Boston, Mass.*

GENTLEMEN:—It gives me great pleasure to officially notify you that your exhibit at the Lewis & Clark Exposition was awarded a gold medal. These medals are furnished by the Exposition Management in bronze, (marked gold) and are not engraved. The Massachusetts Board of Managers have ordered them engraved and plated with gold. We hope to deliver them sometime in January.

The Massachusetts Board of Managers have also ordered a silk banner to be given as a souvenir with each exhibit that received a gold medal. These banners we are presenting with our compliments and with thanks for the splendid exhibits prepared and entrusted to our care.

If you have not already received your exhibits you should do so in a few days.

Very respectfully yours,
(Signed) WILSON H. FAIRBANK,
Executive Commissioner.

DEVELOPMENT OF SUBWAY SYSTEMS.

The report called for by Chapter 48, Resolves of 1905, directing the Commission to inquire into the subject of the further development of the subway systems of the City of Boston, etc., was made to the Legislature on January 19, 1906, and will be found in full in Appendix A.

LEGISLATION.

The term of the Commission expired by limitation with the date of this report. The Legislature of 1906, by Chapter 213 (see Appendix B), extended the term of office of the members of the Commission for three years from that date.

The Legislature of 1906 passed an act relative to the construction of the subway in Cambridge, in which act amendments were made to the legislation already passed regarding the Boston end of that system. That portion of the act (Section 23, Chapter 520) will be found in Appendix C.

SINKING FUNDS.

The following is the condition of the debt and of the sinking funds for the various divisions of the work of the Commission at the date of this report:

SUBWAY (INCLUDING ALTERATIONS.)

(*Debt,* $4,416,000, *outside debt limit.*)

Amount of fund, July 1, 1905		$733,661.90
Interests on bank deposits, July 1, 1905, to date	$1,742.91	
Interest on investments, July 1, 1905, to date	25,262.07	
Revenue, etc., July 1, 1905, to date	92,074.13	
		119,079.11
		$852,741.01

CHARLESTOWN BRIDGE, NO. 1.

(*Debt,* $750,000, *inside debt limit.*)

Amount of fund, July 1, 1905		$108,800.06
Interest on bank deposits, July 1, 1905, to date	$214.58	
Interest on investments, July 1, 1905, to date	3,822.41	
Requirement for debt	8,455.00	
		12,491.99
		$121,292.05

CHARLESTOWN BRIDGE, NO. 2.

(*Debt,* $805,000, *outside debt limit.*)

Amount of fund, July 1, 1905		$118,770.33
Interest on bank deposits, July 1, 1905, to date	$421.86	
Interest on investments, July 1, 1905, to date	3,483.38	
Revenue, etc., July 1, 1905, to date	2,085.28	
Requirement for debt	7,958.00	
		13,948.52
		$132,718.85

EAST BOSTON TUNNEL.

(*Debt,* $3,118,000, *outside debt limit.*)

Amount of fund, July 1, 1905		$31,586.65
Interest on bank deposits, July 1, 1905, to date	$586.43	
Interest on investments, July 1, 1905, to date	873.36	
Revenue, etc., July 1, 1905, to date	45,198.00	
Premium on loans negotiated	217.00	
		46,874.79
		$78,461.44

BOSTON TUNNEL AND SUBWAY.

(*Debt,* $3,456,700, *outside debt limit.*)

Amount of fund, July 1, 1905		$9,088.76
Interest on bank deposits, July 1 ,1905, to date	$271.05	
Interest on investments, July 1, 1905, to date	277.38	
Revenue, etc., July 1, 1905, to date	20,408.13	
Premium on loans negotiated	3,038.00	
		23,994.56
		$33,083 32

Amounts Paid for Rental of the Subway.

The following sums have been paid during the year by the Boston Elevated Railway Company for the use of the subway:

Sept. 30, 1905:		
Total cost of subway	$4,100,502.63	
One quarter's rental		$49,974.88
Alterations: net cost	242,673.93	
One quarter's rental		2,957.59
Dec. 31, 1905:		
Total cost of subway	4,100,504.35	
One quarter's rental		49,974.90
Alterations: net cost	242,673.93	
One quarter's rental		2,957.59
March 31, 1906:		
Total cost of subway	4,100,504.35	
One quarter's rental		49,974.90
Alterations: net cost	242,673.93	
One quarter's rental		2,957.59
June 30, 1906:		
Total cost of subway	4,100,504.35	
One quarter's rental		49,974.90
Alterations: net cost	242,673.93	
One quarter's rental		2,957.59
		$211,729.94
Received on toll account		149.73

Statement of Expenses.

The following is a classified statement of the expenses of the Commission for the year ending June 30, 1906:

SUBWAY.

Section Eight.

Field supplies	$20.00	
Water pipes	1.72	
		$21.72

EAST BOSTON TUNNEL.

General office expenses chargeable directly to East Boston Tunnel:			
Supplies	$31.70		
Stationery and printing	277.79		
		$309.49	
Amount transferred from Boston Tunnel & Subway, general expenses		1,435.83	
Proportion of salary of Chief Engineer		450.00	
			$2,195.32
Carried forward,			$2,217.04

Brought forward,			$2,217.04

ENGINEERING DEPARTMENT.

Rooms—Supplies		$45.31	
Stationery and printing		371.61	
Fuel and light		15.63	
Rental		112.50	
			545.05

MISCELLANEOUS.

Advertising	$5.15		
Teaming	4.00		
Skilled service	518.66		
		$527.81	
Credit:			
Amount transferred to construction, Sections B, C and E, on account of Stock	$8.09		
Amount received from rent of boiler, etc.	27.28		
		35.37	
			492.44

SECTION A.

Field supplies		$2.34	
Labor		74.48	
			76.82

SECTION B.

Wm. H. Smith (Contract No. 208)		$752.00	
Woodbury & Leighton Co. (Contract No. 210)		15,534.71	
Charles Brigham, Architect		1,247.90	
Whittier Machine Co. (Contract No. 203)		17,275.00	
Daniel J. Kiley (Contract No. 246)		493.25	
Construction		43.31	
Field supplies		5,870.69	
Inspection		2.92	
Instruments		2.00	
Labor		1,920.27	
Office supplies		11.05	
Skilled service		28.55	
Teaming		10.00	
			43,191.65

SECTION C.

Wm. H. Smith (Contract No. 208)		$133.00	
Daniel J. Kiley (Contract No. 246)		1,782.07	
Advertising		3.76	
Construction		1,193.89	
Field supplies		370.86	
Inspection		208.04	
Labor		192.30	
Skilled service		11.60	
Teaming		2.88	
			3,898.40
Carried forward,			$50,421.40

Brought forward,		$50,421.40

SECTION D.

Wm. H. Smith (Contract No. 208)	$88.19	
Daniel J. Kiley (Contract No. 246)	699.22	
Field supplies	248.33	
	$1,035.74	
Credit:		
Construction	88.19	
		947.55

SECTION E.

Construction	$6.20	
Field supplies	3.30	
Labor	73.14	
Teaming	2.53	
		85.17

SECTION F.

Field supplies	$417.54	
Instruments	2.25	
Labor	155.85	
	575.64	
Credit:		
Amount received on account of repaving	419.50	
		156.14

BOSTON TUNNEL AND SUBWAY.

General Expenses:		
Office—Furniture	$5.25	
Lighting	47.15	
New rooms	6.30	
Printing	1,640.72	
Rental	3,000.00	
Repairs	18.83	
Stationery supplies	491.26	
Telephone-Telegraph	79.77	
Stenographers	2,379.07	
Messenger	924.00	
Clerks	918.00	
Salaries of Commissioners and Secretary	28,300.00	
	$37,810.35	
Amount transferred to East Boston Tunnel, general expenses	1,435.83	
		36,374.52

ENGINEERING DEPARTMENT.

Rooms—Fuel	$82.35	
Furniture	42.50	
Lighting	423.50	
New rooms	6.30	
Printing	1,769.66	
Rental	2,887.50	
Stationery supplies	1,917.39	
Telephone-Telegraph	296.29	
Travel	45.00	
		7,470.49
Carried forward,		$95,455.27

Brought forward,			$95,455.27

MISCELLANEOUS.

Advertising		$69.52	
Borings:			
Labor		53.30	
Chief Engineer		11,550.00	
Counting traffic		.65	
Field office, Use of		329.62	
Field supplies		79.30	
Inspection		27.72	
Instruments		132.61	
Insurance		83.00	
Labor		993.87	
Messengers		1,906.65	
Paving		227.93	
Legal and expert advice		1,650.00	
Skilled service		38,170.34	
Stenographers		2,612.17	
Stock		12,163.52	
Teaming		76.64	
Testing		325.27	
Tools		257.58	
		$70,709.69	
Credit:			
Amounts proportioned and transferred to proper sections:			
P. McGovern (Contract No. 205)	$19,986.37		
P. W. Hill (Contract No. 207)	36,473.03	56,459.40	14,250.29

SECTION ONE.

(From westerly side of Ash street opposite Nassau street to a point in Washington street near southerly side of Eliot and Kneeland streets.)

Patrick McGovern (Contract No. 220)	$35,892.71	
Advertising	1.50	
Alterations	4,111.22	
Bennet street Sewer:		
Patrick McGovern (Contract No. 205)	13,324.25	
Miscellaneous	1,666.67	
Change of grade	1,798.32	
Construction	2,634.65	
Damages	5,018.15	
Field supplies	60.40	
Instruments	.85	
Labor	699.54	
Lighting	101.45	
Paving	2,885.58	
Legal and expert advice	300.00	
Protection of tenants	440.39	
Skilled service	353.95	
Stationery supplies	25.60	
Teaming	87.12	
Telephone-Telegraph	1.20	
Tools	21.00	
Underpinning	64.28	
Water pipes	215.07	
		69,703.90
Carried forward,		$179,409.46

Brought forward, ...		$179,409.46

Section Two.

(From near the southerly side of Eliot and Kneeland streets to near the northerly side of Boylston street.)

Gow & Palmer (Contract No. 211) .	$1,572.16	
Patrick McGovern (Contract No. 221)	66,479.98	
Alterations	128.32	
Bennet street Sewer:		
Patrick McGovern (Contract No. 205).	6,662.12	
Miscellaneous	833.33	
Construction	4.949.89	
Damages	1,006.66	
Field supplies	474.16	
Insurance	569.27	
Labor	1,023.28	
LaGrange street Station:		
Patrick McGovern (Contract No. 253).	12,986.56	
Miscellaneous	2,620.27	
Lighting	197.51	
Paving	2,526.89	
Legal and expert advice . . .	277.00	
Property damages:		
Takings	25,129.04	
Protection of tenants . . .	32.50	
Skilled service	1,530.90	
Stationery supplies	37.43	
Summer street Sewer:		
Peter W. Hill (Contract No 207) .	1,823.65	
Miscellaneous	235.00	
Teaming	82.09	
Telephone-Telegraph	25.35	
Tools	86.00	
Underpinning	839.62	
Water pipes	2,377.59	
		134,506.57

Section Three.

(From near the northerly side of Boylston street to about 30 feet north of the northerly side of Hayward place.)

Boston Bridge Works (Contract No. 223)	$1,223.62	
Jones & Meehan (Contract No. 226)	35,860.82	
Hugh Nawn Contracting Company (Contract No. 243)	76,601.56	
Alterations	520.88	
Construction	14,161.45	
Damages	1,206.26	
Electric conduits	47.85	
Field supplies	166.18	
Fuel	6.50	
Inspection	162.55	
Instruments	.35	
Insurance	105.32	
Labor	2,218.20	
Lighting	150.57	
Carried forward, ...	$132,432.11	$313,916.03

Brought forward,	$132,432.11	$313,916.03
Paving	557.04	
Printing	11.50	
Legal and expert advice	200.00	
Property damages:		
Takings	1,500.00	
Protection of tenants	1,847.34	
Skilled service	2,662.35	
Stationery supplies	66.17	
Summer street Sewer:		
Peter W. Hill (Contract No. 207)	1,823.65	
Miscellaneous	235.00	
Teaming	173.77	
Telephone-Telegraph	15.50	
Tools	64.55	
Underpinning	19.00	
Water pipes	1,129.26	
		142,737.24

SECTION FOUR.

(*From about* 30 *feet north of Hayward place to about* 50 *feet south of Franklin street.*)

H. P. Converse & Company (Contract No. 231)	$2,503.49	
Hugh Nawn Contracting Company (Contract No. 234)	316,772.21	
Lewis F. Shoemaker & Company (Contract No. 228)	1,011.70	
Advertising	4.88	
Alterations	1,362.98	
Construction	33,290.11	
Damages	11,410.83	
Field supplies	326.41	
Fuel	30.21	
Instruments	12.80	
Insurance	6,091.37	
Labor	1,913.98	
Lighting	56.36	
Paving	699.29	
Protection of tenants	970.94	
Skilled service	4,320.71	
Stationery supplies	65.10	
Summer street Sewer:		
Peter W. Hill (Contract No. 207)	29,178.43	
Miscellaneous	3,760.00	
Summer street Station:		
Hugh Nawn Contracting Company (Contract No. 234)	6,669.95	
New England Structural Company (Contract No. 261)	816.86	
Miscellaneous	1,410.17	
Teaming	3.00	
Telephone-Telegraph	52.98	
Temple place Station:		
Hugh Nawn Contracting Company (Contract No. 234)	20,794.16	
Carried forward,	$443,528.92	$456,653.27

Brought forward,	$443,528.92	$456,653.27
Testing	5.50	
Tools	200.92	
Underpining	300.72	
Water pipes	2,853.80	
		446,889.86

SECTION FIVE.

(*From about* 50 *feet south of Franklin street to near Court avenue.*)

Coleman Bros. (Contract No. 240)	$489,505.60	
Fred A. Houdlette & Son (Contract No. 239)	11,808.12	
Alterations	3,654.75	
Construction	56,674.91	
Damages	190.00	
Field supplies	67.87	
Fuel	31.05	
Furniture	27.80	
Inspection	173.81	
Insurance	1,705.76	
Labor	2,277.49	
Lighting	53.12	
Paving	227.18	
Printing	54.25	
Legal and expert advice	300.00	
Protection of tenants	2.20	
Skilled service	8,284.99	
Stationery supplies	56.00	
Summer street Sewer:		
Peter W. Hill (Contract No. 207)	3,647.30	
Miscellaneous	470.00	
Teaming	5.50	
Telephone-Telegraph	58.11	
Tools	234.97	
Water pipes	3,128.47	
		582,639.25

SECTION SIX.

(*From near Court avenue to the north side of the East Boston tunnel.*)

Alterations	$4.75	
Borings:		
P. J. Healey	413.39	
Materials	5.79	
Construction	44.22	
Field supplies	43.40	
Labor	317.95	
Lighting	231.40	
Skilled service	3.00	
Stationery supplies	8.86	
Test pits	1,212.75	
Testing	5.85	
Teaming	12.81	
Tools	1.35	
Underpinning	543.38	
		2,848.90
Carried forward,		$1,489,031.28

Brought forward,		$1,489,031.28

SECTION SEVEN.

(*From the north side of the East Boston tunnel to* 150 *feet north of State street.*)

New England Structural Company (Contract No. 254)	$1,715.54	
Advertising	1.99	
Borings	90.97	
Labor	67.90	
Lighting	.82	
Skilled service	57.69	
Stationery supplies	.21	
Teaming	.81	
Telephone-Telegraph	.20	
Test pits	24.31	
Testing	7.98	
Underpinning	1.50	
Water pipes	1,894.41	3,864.33

SECTION EIGHT.

(*From* 150 *feet north of State street to Hanover street.*)

Patrick McGovern (Contract No. 257.)	$83,665.67	
New England Structural Company (Contract No. 254)	5,770.23	
Advertising	71.71	
Alterations	99.15	
Borings	160.75	
Construction	12,567.41	
Field supplies	18.50	
Instruments	.70	
Insurance	219.00	
Labor	583.80	
Lighting	12.50	
Portland street Sewer:		
Coleman Bros. (Contract No. 258)	31,555.20	
Miscellaneous	4,624.21	
Printing	154.35	
Legal and expert advice	30.00	
Protection of tenants	143.26	
Skilled service	1,421.49	
Stationery supplies	11.14	
Teaming	.70	
Telephone-Telegraph	27.21	
Underpinning	19.36	
Water pipes	1,897.47	
		143,053.81

SECTION NINE.

(*From Hanover street to Haymarket square.*)

New England Structural Company (Contract No. 256)	$6,363.65	
Advertising	74.56	
Borings	48.67	
Construction	363.15	
Field supplies	9.50	
Carried forward,	$6,859.53	$1,635,949.42

Brought forward,	$6,859.53	$1,635,949.42
Labor	213.14	
Legal and expert advice	50.00	
Protection of tenants	29.70	
Skilled service	1,043.59	
Stationery supplies	3.46	
Telephone-Telegraph	.21	
		8,199.63

SECTION TEN.

(In Haymarket square for a length of about 300 feet, on the easterly side of the old subway.)

Advertising	$3.98	
Skilled service	842.77	
		846.75

INTEREST.

Boston Tunnel and Subway	76,146.02
Grand Total	$1,721,141.82

SUMMARY.

	From beginning of work to June 30, 1905.	June 30, 1905, to June 30, 1906.	Total.
Subway — Subway Commission	$14,131.16		$14,131.16
Part of General Expenses	117,473.24		117,473.24
Engineering and Miscellaneous	407,475.48		407,475.48
Section One	239,407.12		239,407.12
Two	363,605.50		363,605.50
Three	300,639.36		300,639.36
Three and one-half	9,355.70		9,355.70
Four	469,620.33		469,620.33
Five	388,894.69		388,894.69
Six	327,494.86		327,494.86
Seven	231,504.27		231,504.27
Eight	95,614.24	$21.72	95,635.96
Eight and one-half	76,639.47		76,639.47
Nine	299,452.07		299,452.07
Ten	254,497.88		254,497.88
Eleven	270,310.57		270,310.57
Interest	258,575.60		258,575.60
	$4,124,691.54	$21.72	$4,124,713.26
Amount transferred to alterations, as noted in 11th report	4.95		4.95
Total	$4,124,686.59	$21.72	$4,124,708.31

Alterations — Part of General Expenses	$28,945.53		$28,945.53
Section Three	2,568.26		2,568.26
Four	163.42		163.42
Five	30,233.01		30,233.01
Seven	178,516.16		178,516.16
Nine	3.00		3.00
Ten	534.04		534.04
Interest	1,905.56		1,905.56
Amount transferred from subway, as noted in 11th report	4.95		4.95
Total	$242,873.93		$242,873.93
Bridge — Part of Gen. Expenses	$53,820.57		$53,820.57
Construction, etc.	1,516,377.41		1,516,377.41
Total	$1,570,197.98		$1,570,197.98
East Boston Tunnel — Part of General Expenses	$158,815.40	$2,195.32	$161,010.72
Engineering Expenses	174,659.30	1,037.49	175,696.79
Section A	98,762.87	76.82	98,839.69
B	1,212,035.87	43,191.65	1,255,227.52
C	482,027.13	3,898.40	485,925.53
D	243,742.70	947.55	244,690.25
E	187,951.47	85.17	188,036.64
F	230,990.91	156.14	231,147.05
Interest	248,156.88		248,156.88
Total	$3,037,142.53	$51,588.54	$3,088,731.07
Boston Tunnel and Subway — Part of General Expenses	$72,165.58	$36,374.52	$108,540.10
Engineering Expenses	230,044.02	21,720.78	251,764.80
Section One	693,551.18	69,703.90	763,255.08
Two	178,771.81	134,506.57	313,278.38
Three	83,055.06	142,737.24	225,792.30
Four	237,326.01	446,889.86	684 215.87
Five	17,501.19	582,639.25	600,140.44
Six	.60	2,848.90	2,849.50
Seven		3,864.33	3,864.33
Eight		143,053.81	143,053.81
Nine		8,199.63	8,199.63
Ten		846.75	846.75
Interest	16,930.21	76,146.02	93,076.23
Total	$1,529,345.66	$1,669,531.56	$3,198,877.22
Grand Total	$10,504,246.69	$1,721,141.82	$12,225,388.51

The report of the Chief Engineer is appended.

GEORGE G. CROCKER,
CHARLES H. DALTON,
THOMAS J. GARGAN,
GEORGE F. SWAIN,
HORACE G. ALLEN.
Boston Transit Commission.

On June 29, 1906, Commissioner Dalton sent the following communication to His Honor the Mayor:

June 28, 1906

To His Honor the Mayor, John F. Fitzgerald:

Sir:—My present term of service as member of the Boston Transit Commission ends on the 30th inst.

By Chapter 213, Acts of 1906, the term of office of the members of the Commission is extended for three years from July 1, 1906.

Having had the pleasure of serving the city in this connection for the past thirteen years, and highly appreciating the honor of a reappointment by the General Court, I most respectfully decline to accept it, as I wish to retire from further public service, and hereby place my declination in your hands, to take effect upon the appointment and confirmation of my successor, and remain

Your obedient servant,
(Signed) C. H. DALTON.

Mr. Dalton was named by Hon. Nathan Matthews, then Mayor, January 1, 1894, as a member of the original Subway Commission, and was the Chairman of that body. Upon the organization of the Boston Transit Commission, August 15, 1894, Mr. Dalton was elected Chairman, but declined the office.

His remaining associates on the Commission take this opportunity to express in the warmest terms their appreciation of their fellow commissioner, both as official and as a private citizen. His service has been of great value and has been rendered in accordance with the highest standards of official duty.

GEORGE G. CROCKER,
THOMAS J. GARGAN,
GEORGE F. SWAIN,
HORACE G. ALLEN.

REPORT OF THE CHIEF ENGINEER.

BOSTON, JUNE 30, 1906.

GEORGE G. CROCKER, CHARLES H. DALTON, THOMAS J. GARGAN, GEORGE F. SWAIN, HORACE G. ALLEN, *Boston Transit Commissioners.*

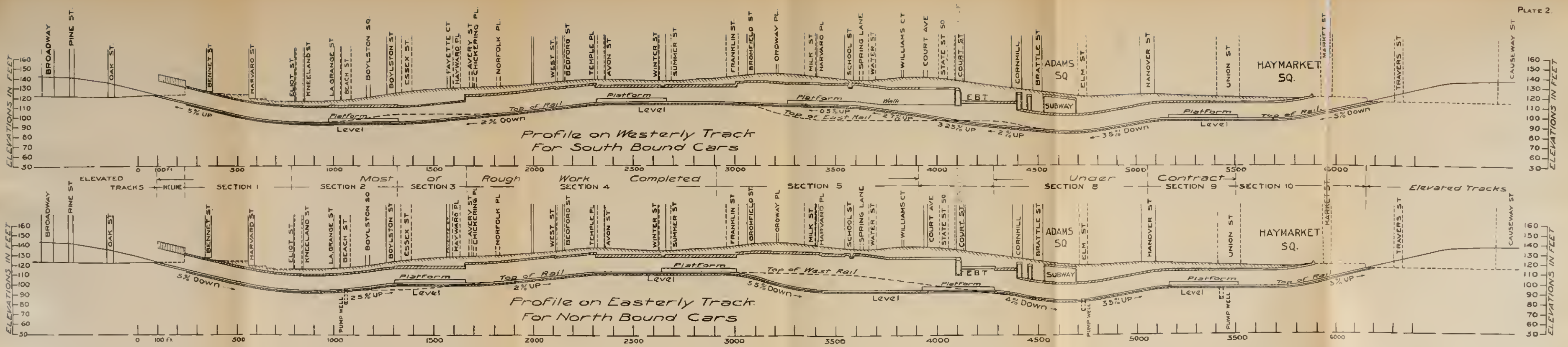
GENTLEMEN: I submit herewith my report of work on the Washington-street Tunnel for the past year, including references to earlier work that appear desirable and some repetition from former reports; also of work done in connection with the East Boston Tunnel.

WASHINGTON-STREET TUNNEL.

At the date of the last annual report, the southerly incline, between Ash street and a point 98 feet south of Bennet street, was completed, and tunnel work was in progress on Sections 1 to 5, inclusive, extending from the last-named point to near Court avenue. Since that date, the rough tunnel work on all these sections in Washington street proper has been completed and the building in of spaces for stations under some of the side streets has been begun. Tunnel construction has been begun on Sections 8 and 9, extending from a point about 150 feet north of State street to the southerly end of Haymarket square. The construction of the tunnel for a distance of about 350 feet near State street has been delayed, awaiting the determination of questions concerning entrances to and exits from the station in that locality. Work to the north of Haymarket square has also been delayed on account of discussions respectively concerning an underground loop near Causeway street, the interference with the Relief Station Hospital, and connections with a proposed elevated railway from East Cambridge.

The general layout of the tunnel is shown on Plate I. and the profile on Plate II.

PLATE 2.



PROFILE OF WASHINGTON ST. TUNNEL

BOSTON TRANSIT COMMISSION

GEORGE G. CROCKER, Chairman
CHARLES H. DALTON
THOS. J. GARGAN
GEORGE F. SWAIN
HORACE G. ALLEN
} COMMISSIONERS

HOWARD A CARSON, Chief Engineer

Note. Datum is about $100\frac{64}{100}$ feet below mean low water of the sea.

HELIOTYPE CO BOSTON

The tunnel will have a total length of about 6100 feet. The last report contained, on page 40, data in regard to the percentage of straight and curved track, as also of level and inclined track, sub-divided into varying rates of curvature and inclination respectively. These have not been materially varied by the studies made during the past year.

The profiles show a maximum depth at rail level, below mean low water of Boston Harbor, of nearly sixteen feet at Adams square, where the new tunnel is to be carried under the original Boston Subway. The foundation of the tunnel will be about four feet below the top of rails and 38 feet below the surface of Adams square. The following table gives relative depths of various points of the tunnel:

WASHINGTON-STREET TUNNEL.

APPROXIMATE RAIL LEVELS AT VARIOUS POINTS.

LOCATION.	Above or Below Mean Low Water of Boston Harbor.	Above or Below Street Surface.	Above Lowest Point of Tunnel (Adams Square).
Proposed elevated structure at Broadway	41 ft. above.	20 ft. above.	57 ft.
Eliot street	6 ft. below.	21 ft. below.	10 ft.
Summer street	12 ft. above.	21 ft. below.	28 ft.
School street:			
West track	9 ft. above.	26 ft. below.	25 ft.
East track	6 ft. below.	41 ft. below.	10 ft.
Adams square	16 ft. below.	34 ft. below.	—
Elevated structure at North Station	36 ft. above.	21 ft. above.	52 ft.

Cross-sections and other data are shown on Plates 4, 5, 6, 7, 9, 10 and 11. The frequent variations in cross-sections, and the considerations leading to their adoption, are discussed on pages 41 and 42 of the last report.

VENTILATION OF THE WASHINGTON-STREET TUNNEL.

As in the original Subway and in the East Boston Tunnel, fresh air is to be admitted at the stations and portals and withdrawn from the tunnel at points about midway between. It is not in general practicable to discharge the vitiated air directly into the outer air at the points where it (the vitiated air) is taken from the tunnel, nor is it practicable to discharge through grated areas in the sidewalks, the latter during the day being densely crowded. Air admitted at the portals and at the station entrances and leaving the tunnel at intermediate points will pass thence through specially constructed ducts—in some places underneath and in others above the tunnel—having a minimum cross-sectional area of about 40 square feet and a length of from 270 feet to 430 feet, to fan chambers. There will be room in each chamber for two single-inlet centrifugal fans, each with a capacity of 20,000 cubic feet or more per minute, giving an average velocity of air in the tunnel of upwards of 1 foot per second, equivalent to changing the air in each section three or more times per hour.

The general movement of the air in the Washington-street Tunnel is shown on Plate 3.

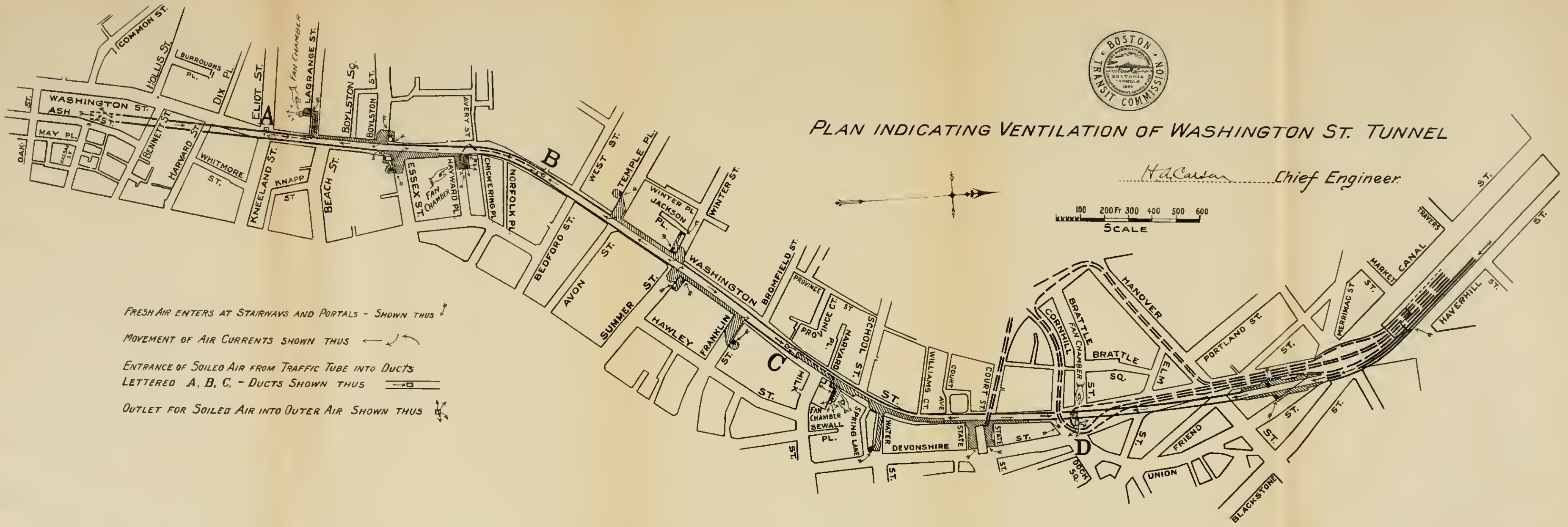
It may be mentioned here that practically all of the stairways and station entrances and exits on the Washington-street Tunnel are on what was formerly private property which has been or shortly will be taken by the Transit Commission and that all but one of the fan chambers and exits for vitiated air will also be on what was formerly private ground. The one exception is in the middle of Adams square. The discharge in that case will be through a grated opening on the easterly side of the Adams monument.

The following table gives additional details:

COURSES OF VENTILATING CURRENTS: WASHINGTON-STREET TUNNEL.

1.—AIR DISCHARGED AT LAGRANGE STREET STATION.

Inlets for Fresh Air.	Course of Air in Tunnel.	Course of Air in Duct.
South Portal. LaGrange-st. entrance. Boylston-st. entrance.	Northerly, from south portal to invert duct inlet at A on Plate 3; about 576 feet. Southerly, from Boylston-street Station entrance to A; about 530 feet.	From A, northerly under tunnel invert and westerly under LaGrange-street Station to fan chamber and chimney at LaGrange-street Station; about 370 feet.



PLAN INDICATING VENTILATION OF WASHINGTON ST. TUNNEL

H.A.Carson Chief Engineer.

FRESH AIR ENTERS AT STAIRWAYS AND PORTALS – SHOWN THUS ↕

MOVEMENT OF AIR CURRENTS SHOWN THUS ⟵ ↙ ↖

ENTRANCE OF SOILED AIR FROM TRAFFIC TUBE INTO DUCTS LETTERED A, B, C, – DUCTS SHOWN THUS ⟶▫

OUTLET FOR SOILED AIR INTO OUTER AIR SHOWN THUS ✣

HELIOTYPE CO. BOSTON

2.—AIR DISCHARGED AT HAYWARD-PLACE STATION.

Inlets for Fresh Air.	Course of Air in Tunnel.	Course of Air in Duct.
Essex-st. entrance. Hayward-pl. entrance Temple-pl. entrance. Winter-st. entrance.	Northerly, from Essex-street Station entrance to arch duct inlet at B on Plate 3; about 650 feet. Southerly, from Winter-street Station entrance to B; about 650 feet.	From B, southerly under tunnel arch and easterly under Hayward place Station, to fan chamber and chimney near Hayward-place entrance; about 430 feet.

3.—AIR DISCHARGED AT OLD SOUTH MEETING HOUSE STATION.

Inlets for Fresh Air.	Course of Air in Tunnel.	Course of Air in Duct.
Summer-st. entrance. Franklin-st. entrance Old South Meeting House entrance. Water-street entrance. Old State House entrance.	Northerly, from Summer-st. Station entrance to arch duct inlet at C on Plate 3; about 550 feet. Southerly, from Old State House Station entrance to C; about 900 feet.	From C, northerly under tunnel arch to fan chamber and chimney near Old South Meeting House entrance; about 270 feet.

4.—AIR DISCHARGED AT SURFACE IN ADAMS SQUARE.

Inlets for Fresh Air.	Course of Air in Tunnel.	
Old State House entrance. Two entrances between Hanover street and Haymarket square. North Portal.	Northerly, from Old State House Station entrance to fan chamber and surface grating at D on Plate 3; about 500 feet. Southerly, from north portal to D; about 1440 feet.	No duct.

CONSTRUCTION METHODS; MAINTENANCE OF STREET TRAFFIC.

The methods of construction during the past year have not greatly varied from those described on pages 42 and 43 of last year's report. Contracts have been framed and the construction of the Washington-street Tunnel carried on with a view of reducing to a minimum the inconvenience and annoyance to abutters and to those using the street.

In Sections 4 and 5, located in the busiest part of the thoroughfare, occupation of the surface for actual excavation has been practically limited to nights and Sundays. The disturbance of the street surface in business hours has been restricted to small openings near the curbs, 100 feet apart, for the placing of concrete and passing building and bracing materials in and out of the trenches. In the other sections, excavation has been permitted in the day, but the contractor has been limited to the use of spaces not exceeding 30 feet in length by 10 feet in width and at least 100 feet apart. In some isolated cases one-third of the width of the sidewalk has been used for construction purposes. The running of the street cars in the day has not been interfered with unless in some special emergency, and then for a short time only.

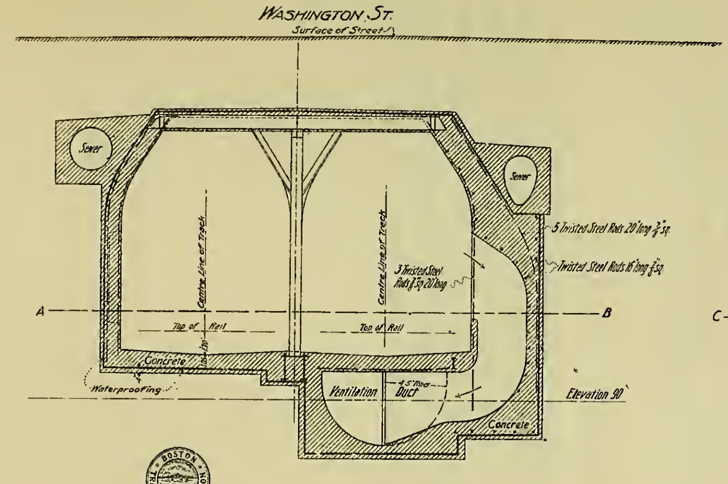
During the night and Sundays the contractors have been allowed to use as much of the street surface as necessary, providing that sufficient sidewalk accommodation was given pedestrians and room left for fire engines to pass through and into adjoining streets; street cars have in the night frequently been diverted to neighboring streets.

Fires in contractors' engines have been so managed as to produce as little offence from smoke as practicable, and smoke, fumes, and disagreeable smells have been kept out of premises as far as possible. To lessen the annoyance from these causes and to avoid danger of fire, most of the lighting has been done by electricity.

The tunnel, in some cases, passes under buildings, and during its construction it becomes necessary to occupy the portion of the basements within the line of the tunnel, together with a working space of about 5 feet in width on each side. In many other cases the tunnel is in such close proximity as to make it expedient to underpin the buildings. In order to do this work there has frequently been an occupation in the basements of the buildings of a space about 5 feet in width parallel to the front walls or piers, and the first operation has been to put up a tight matched board partition, covered with asbestos, to separate this space from the rest of the basement. Such changes of heating, plumbing and lighting fixtures as may be necessary are next made. The walls and piers of the building are then supported upon steel girders, after which excavation is carried on underneath to the requisite depth and the new foundations are brought up to the old.

While the operations of building the tunnel are going on, the surface of the street is kept covered with timber bridging flush

PLATE 4.



BOSTON TRANSIT COMMISSION

SECTION 2

WASHINGTON ST. TUNNEL

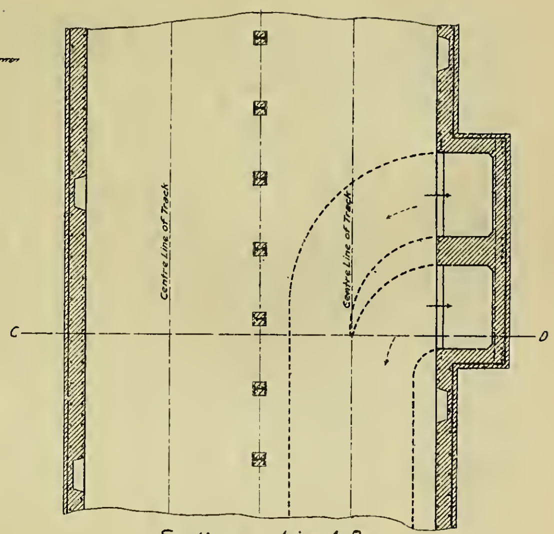
SECTIONS SHOWING OPENINGS INTO AIR DUCT FROM TUNNEL AT ELIOT ST.

STA. 8 + 16

H.A.Carson CHIEF ENGINEER

Note: Elevations are referred to a datum about $100\frac{64}{100}$ feet below mean low water of the sea.

0 4ft. 8 12
Scale



Section on Line A-B

HELIOTYPE CO., BOSTON.

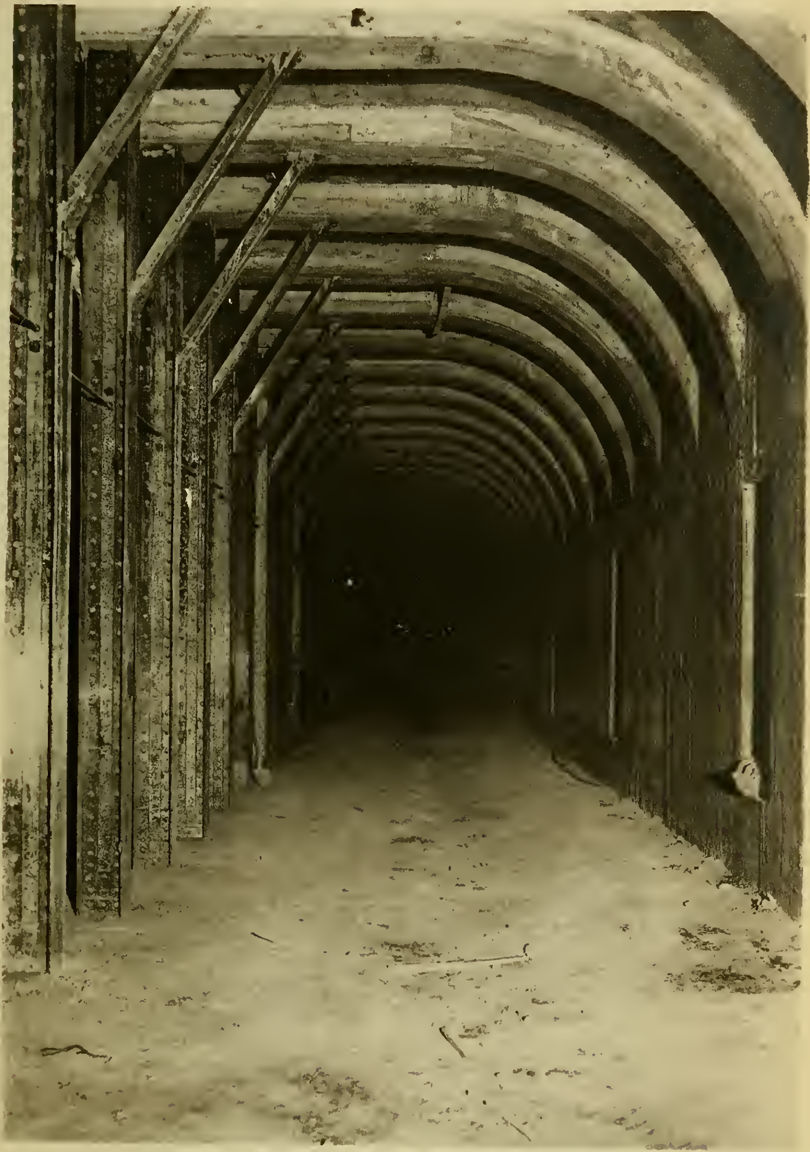
with the pavement for the maintenance of street traffic, the earth being taken out and materials passed in and out of the trenches through the small hatchways, near the curbs, already referred to.

The tunnel having been completed, the street is backfilled and paved temporarily on a gravel base, this paving being frequently renewed until the final pavement is put in after the settlement of the underlying earth has presumably ceased.

It is intended, as far as conditions permit and as far as the Commission can influence the municipal departments and the public service corporations, to have such pipes and conduits as are to be relaid at the side of and over the roof of the tunnel put in place before the backfilling over the structures takes place. Often, however, this cannot be accomplished, and the digging by the various departments and public service companies to put the new pipes and structures into the new locations assigned to them causes a more unsightly appearance above the surface of the street than was caused by the tunnel work.

STATISTICAL TABLES.

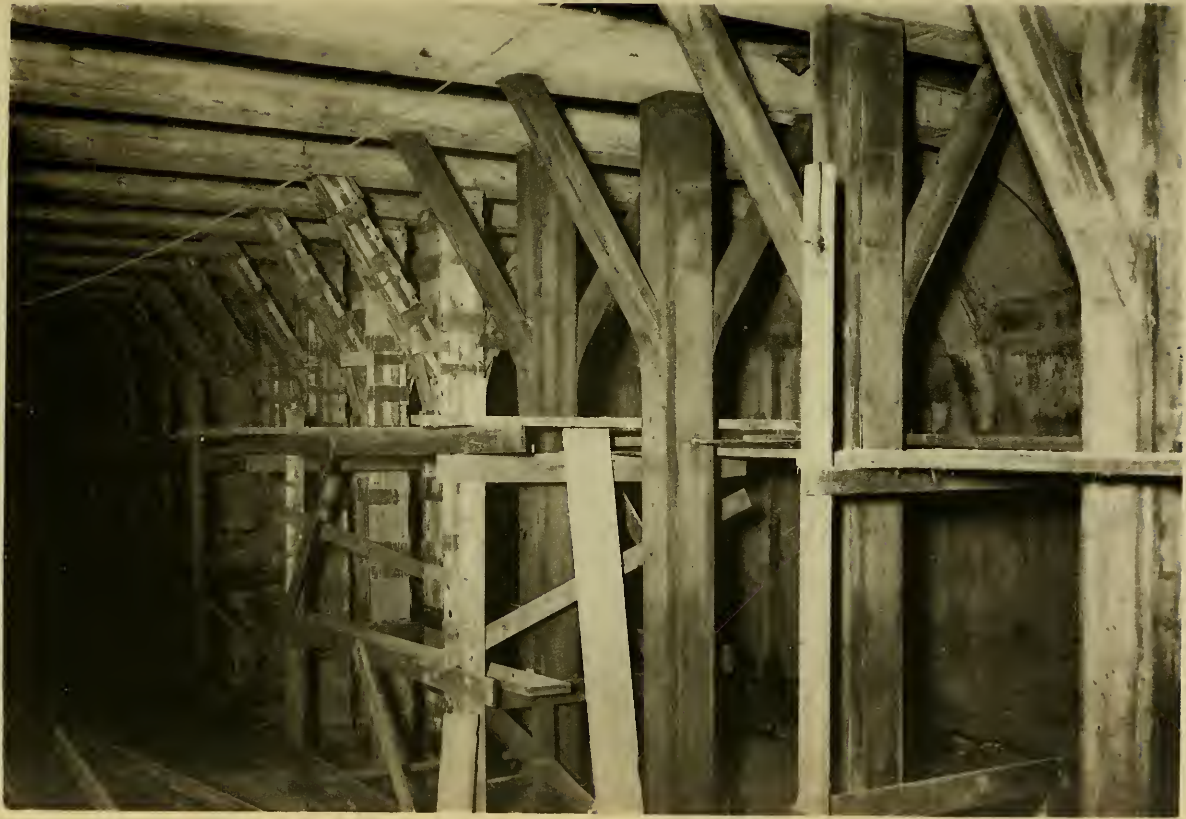
The principal facts in regard to construction and other contracts are given in the following tables; for convenience of reference, these include the work done previous to the year under review. The pages which follow the tables contain additional information, less suitable for tabulation, compiled mainly from the reports of the assistant engineers.



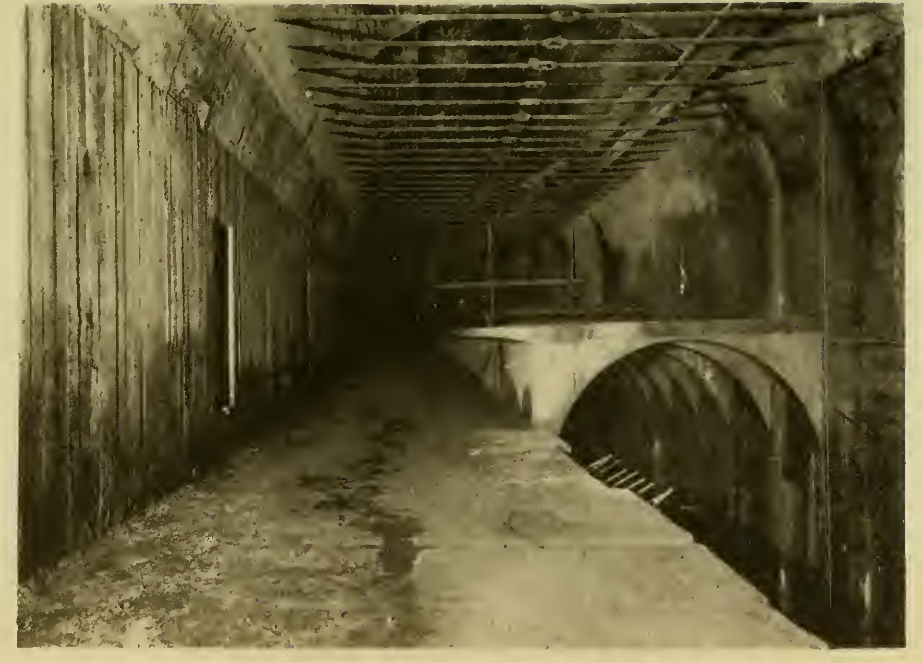
SECTION 4. EASTERLY SIDE LOOKING NORTH. THE SOUTHERLY END OF THE STATION PLATFORM AT SUMMER ST. SHOWS IN BACKGROUND ON THE RIGHT.

COCKAYNE, BOSTON.

PLATE 6



SECTION 4 LOOKING NORTH FROM NEAR TEMPLE PLACE CONCRETING AROUND STEEL COLUMNS



SECTION 5. LOOKING NORTH, SHOWING PORTION OF PLATFORM OF MILK ST. STATION OVER THE TRACK FOR NORTH-BOUND CARS.

No. 1.—CONSTRUCTION.

SECTION.	Location (From South to North).	Plates in This and Previous Annual Reports.	Assistant Engineer on Ground.	Contractor and Date of Contract.	Amount of Contract.	Appendices Showing Bids in This and Previous Annual Reports.	Date of Completion Named in Contract.
SOUTHERLY INCLINE.	West side of Ash Street, opposite Nassau Street, to 98 feet south of Bennet Street.	XI., 3.	P. F. O'Brien.	Harry P. Nawn, Oct. 4, 1904.	$6,063.00	XI., K–10	Oct. 29, 1904. (Certificate of completion, Nov. 5, 1904.)
1.........	98 feet south of Bennet Street to near south side of Kneeland Street.	XI., 4.	P. F. O'Brien.	Patrick McGovern, Nov. 17, 1904.	99,774.00	XI., K–12.	June 1, 1905. (Certificate of completion, July 15, 1905.)
2.........	Near south side of Kneeland Street to near north side of Boylston Street; some work in Boylston Street.	XI., 5 and 6.	R. B. Farwell.	Patrick McGovern, Nov. 28, 1904.	114,914.50	XI., K–14.	June 20, 1905. (Certificate of completion, Aug. 10, 1905.)
3.........	Near north side of Boylston Street to 28 feet north of Hayward Place; some work in Essex Street and Hayward Place.	XI., 7, 8, 9.	R. B. Farwell. L. L. Street, Sept., 1905, to Feb., 1906.	Jones & Meehan, Dec. 19, 1904. Hugh Nawn Contracting Co, July 31, 1905.	128,103.00	XI., K–16.	July 31, 1905. (Certificate of completion, Dec. 13, 1905)
4.........	28 feet north of Hayward Place to 53.5 feet south of Franklin Street.	XI., 10, 11, 12, 13. 14; XII., 5, 6.	L. L. Street.	Hugh Nawn Contracting Co., Feb. 18, 1905.	466,482.00	XI., K–20.	Jan. 1, 1906. (Certificate of completion, Nov. 27, 1905.)
5.........	53.5 feet south of Franklin Street to 14.5 feet south of Court Avenue.	XI., 15; XII., 7, 8.	P. F. O'Brien.	Coleman Brothers, May 19, 1905.	483,977.50	XI., K–23.	July 1, 1906. (Certificate of completion, March 19, 1906.)
8........	150 feet north of State Street to Hanover Street.	XII., 9.	R. B. Farwell.	Patrick McGovern, March 12, 1906.	310,267.50	XII., J.	Dec. 31, 1906.
9.........	Hanover Street to Haymarket Square.	XII., 10, 11, 12.	P. F. O'Brien.	James J. Coughlan Construction Co., May 22, 1906.	198,275.00	XII., N.	Jan. 31, 1907.

No. 2.—PROGRESS OF CONSTRUCTION.

Section.	Dates of Beginning.		Dates of Completion.		Amount of Work Done, Year Ending June 30, 1906.		Total Amount of Work Done to and Including June 30, 1906, from Beginning of Work.		Number of Men Ordinarily Employed by the Contractor, Year Ending June 30, 1906.	
	Excavation.	Concrete.	Excavation	Concrete.	Excavation in cu. yds.	Concrete in cu. yds.	Excavation in cu. yds.	Concrete in cu. yds.	Day.	Night.
SOUTHERLY INCLINE	Oct. 6, 1904.	Oct. 11, 1904.	Nov. 5, 1904.	Nov. 4, 1904.	......	......	665	480	......	......
1....	Nov. 21, 1904.	Nov. 29, 1904.	June 18, 1905.	June 28, 1905.	......	300	11,224	4,624	55	38
2.............	Nov. 26, 1904.	Dec. 1, 1904.	July 22, 1905.	Aug. 10, 1905.	2,861	927	20,361	4,427	75	50
3.............	Dec. 20, 1904.	Dec. 31, 1904.	Nov. 26, 1905.	Dec. 4, 1905.	10,670	3,304	19,670	4,554	60	60
4.............	Feb. 21, 1905.	Feb. 28, 1905.	Nov. 28, 1905.	Nov. 28, 1905.	28,193	6,769	50.337	11,506	150	227
5.............	May 26, 1905.	June 7, 1905.	March 8, 1906.	March 16, 1906.	46,000	12,560	52,900	13,100	102	104
8.............	March 24, 1906.	April 4, 1906.	....	....	14,000	3,500	14,000	3,500	110	95
9.............	May 30, 1906.	June 10, 1906.	....	....	4,000	164	4,000	164	81	73

NOTE.—The estimated total quantities for Sections 8 and 9 are:

	Excavation.	Concrete.
Section 8:	25,000 cu. yds.	9,200 cu. yds.
Section 9:	20.000 " "	5,700 " "

No. 3.—EXCAVATION DATA.

Section.	DESCRIPTION OF MATERIAL.	Disposition of Surplus.
SOUTHERLY INCLINE.	Below level of basements a stiff blue clay with very little water.	Dumped near junction of Dorchester Av. and Southampton St., South Boston, a distance of 8000 ft.
1	Upper portion mostly clay and gravel. About four feet from bottom a layer of sand with water; below this a stiff blue clay mixture with very little water.	About 9000 cu. yds. dumped near Dorchester Av. and Southampton St., a distance of 8000 ft.; balance hauled to scow (7000 ft.) and dumped at sea outside of Boston Light.
2	First seven or eight feet, sand and gravel filling. Below that, yellow or blue clay with some sand; bottom generally soft and wet.	Mostly hauled to dump at Kemp St., South Boston, 8000 ft. distant.
3	In Essex St., first seven or eight feet, sand and gravel filling, then ten feet clay; below that blue clay. In Washington St., opposite Essex St., sand and gravel filling to ten feet below surface; below that yellow clay and sand. North of Essex St., sand and gravel filling to ten feet below surface, then fourteen feet clay and sand; below this, sharp brown sand. Below thirty feet from surface, considerable water in Washington St.	Jones & Meehan hauled mostly to Commonwealth dump, between B and E streets, South Boston, a distance of 6000 to 7000 ft. The Hugh Nawn Contracting Co. changed to scow, 4000 ft. distant, dumping at sea outside of Boston Light.
4	Filling in first five or six feet, then hard blue clay to ten feet below surface. North of Temple Place, below the clay, hard coarse gravel and sand; south of Temple Place, fine brown sand. Very little water.	Mostly hauled 3500 feet to scow and dumped at sea outside of Boston Light
5	South of Spring Lane, a hard compact mixture of clay and gravel. Between Milk and Franklin Streets, east side, a large quantity of water was encountered. North of Spring Lane, a mixture of sand and gravel, without water.	Hauled to scow, 4000 ft. distant, and dumped at sea outside of Boston Light.
8	Southerly from Brattle St., mostly gravel and sand with some clay; generally blue clay in bottom. Under the Subway, blue clay with stones and streaks of sand. Northerly from Elm St., after about eight feet of sand and gravel filling, the excavation was mostly through clay with a little sand.	Mostly hauled 3000 ft. to scow, and dumped at sea outside of Boston Light.
9	Stiff blue clay with a little sand; no water.	Hauled 3800 ft. to scow and dumped at sea outside of Boston Light.

No. 4.—STEELWORK.

Section.	Contractor for Furnishing Steelwork, and Date of Contract.	Amount of Contract.	Appendices Showing Bids in This and Previous Annual Reports.	Date of Completion Named in Contract.	Date of Certificate of Completion.
Southerly Incline.	Harrington, Robinson & Co., Sept. 10, 1904.	$230.00	....	Sept. 23, 1904.	Delivered Sept. 30, 1904.
1............	New England Structural Co., Sept. 9, 1904.	17,600.00	XI., K–9.	Nov. 12. 1904.	Dec. 12, 1904.
2............	Boston Bridge Works, Oct. 12, 1904.	21,010.50	XI., K–11.	Jan. 12, 1905.	March 18, 1905.
3............	Boston Bridge Works, Nov. 23, 1904.	24,125.00	XI., K–15.	March 3, 1905.	April 14, 1905.
4............	Lewis F. Shoemaker, Feb. 1, 1905.	21,076 00	XI., K–17.	May 25, 1905.	May 5, 1905.
4 (additional)..	New England Structural Co, May 9, 1906.	675.00	XII., M.	June 9, 1906.	May 28, 1906.
5............	F. A. Houdlette & Son, May 31, 1905.	11,124.55	XI., K–22.	Sept. 1, 1905.	Sept. 22, 1905.
7 and 8.	New England Structural Co.. Feb. 14, 1906.	7,764.00	XII.. H.	May 1, 1906.	May 11, 1906.
9............	New England Structural Co., March 7, 1906.	28,575.00	XII., I.	June 26, 1906.	....
9 (additional).	H. P. Converse & Co., May 8, 1906.	2,200.00	XII.. L	July 14, 1906.	
10 (part of)...	New England Structural Co., June 8, 1906.	11,213.64	XII., O.	Aug. 4, 1906.	....

Incline near Ash Street.

NOTE.—See four tables following page 28.

The tearing down of old buildings and the construction of the incline leading to Section 1 of the Washington-street Tunnel are referred to on page 48 of the last report.

Section 1 of the Washington-Street Tunnel.

NOTE.—See four tables following page 28.

The type of structure is described on page 48 of the Eleventh Annual Report. At the close of last year the work was nearly completed and operations on the tunnel proper extended only a fortnight into the year under review. Extra work, including the construction of a boiler room in the Sherburne Building, was carried on during the present year.

Section 2 of the Washington-Street Tunnel.

NOTE.—See four tables following page 28.

At the date of the last annual report, this section was practically completed except the construction of platform and approach in Boylston street and the adjoining two-track subway.

Section 3 of the Washington-Street Tunnel.

NOTE.—See four tables following page 28.

Pages 53-55 of the last report describe the varying cross-sections of the structure and the methods adopted for underpinning and construction. At the date of that report the westerly wall was practically all built to the springing line, but only 85 feet of the center wall and arch had been built. The original contractors relinquished the work on July 19, 1905, and it was taken over by the Hugh Nawn Contracting Co., substantially on the basis of their bid (the next lowest) submitted when the original contract was let. The new contractors made satisfactory progress with the work.

Section 4 of the Washington-Street Tunnel.

NOTE.—See four tables following page 28.

This section, including the south-bound platform south of Winter street and most of the north-bound platform north of Summer street, was fully described in last year's report. Since that date, the contract was extended so as to include portions of the station entrances at Temple place and Summer street.

Section 5 of the Washington-Street Tunnel.

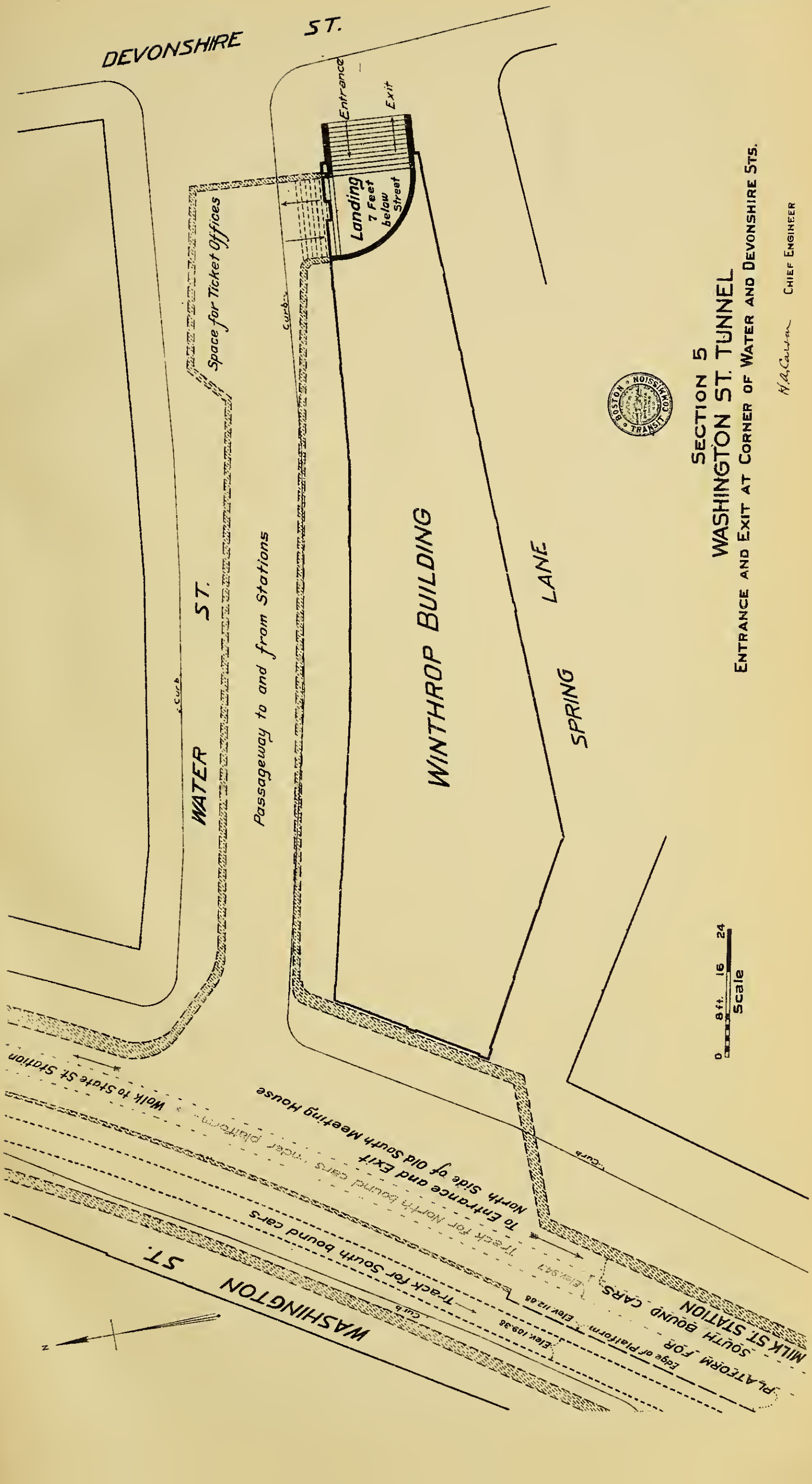
NOTE.—See four tables following page 28.

General Description of Structure.—The section includes the northerly 95 feet of the Summer and Franklin-street Station platform, the Milk-street Station platform, and about 570 feet of two-track tunnel, a total length of 1,015 feet. The included portion of the Summer-street Station has a steel framework of 20-inch and 24-inch I-beams, similar to the adjoining portion of Section 4. The remainder of the section has a concrete arch, with 2¼-inch tie-rods. The arch rests on reinforced concrete side walls, except at the entrances, where a line of steel girders set on steel columns is employed. Opposite School-street a flat roof of steel I-beams and concrete replaces the arch for about 35 feet to allow space for pipes and conduits to be carried over the tunnel.

Upon leaving the Summer-street Station, the north-bound track descends rapidly, and reaches a maximum depth of about 15 feet below the south-bound track, allowing the Milk-street Station platform for the latter to be built over the former. A platform 14 feet wide is thus obtained without increasing the width of the regular tunnel section. See Plate 7. North of the Old South Meeting House the width of the platform is increased to 30 feet for a distance of about 100 feet. Access to this, both from Washington street and Milk street, will be provided by means of entrances and stairways to be built in and near the Meeting House yard. There will also be an entrance at the corner of Water and Devonshire streets, in anticipation of which a 12-foot passage, about 170 feet long, has been built during the year through Water street to connect the entrance with the station. See Plate 8. North of the station a passageway has been built over the north-bound track to the end of the section, to form a connection with the State-street Station and the East Boston Tunnel.

Details of Construction.—Work to the south of Milk street, begun in May, 1905, was carried on day and night. Construction north of Water street began June 2, 1905, and was carried on mainly at night. The closure was made opposite the Old South Meeting House. The usual procedure was followed of excavating trenches for the side walls and building them up to the arch, then excavating for and turning the arch, and, lastly, removing the central core of earth and

PLATE 8.

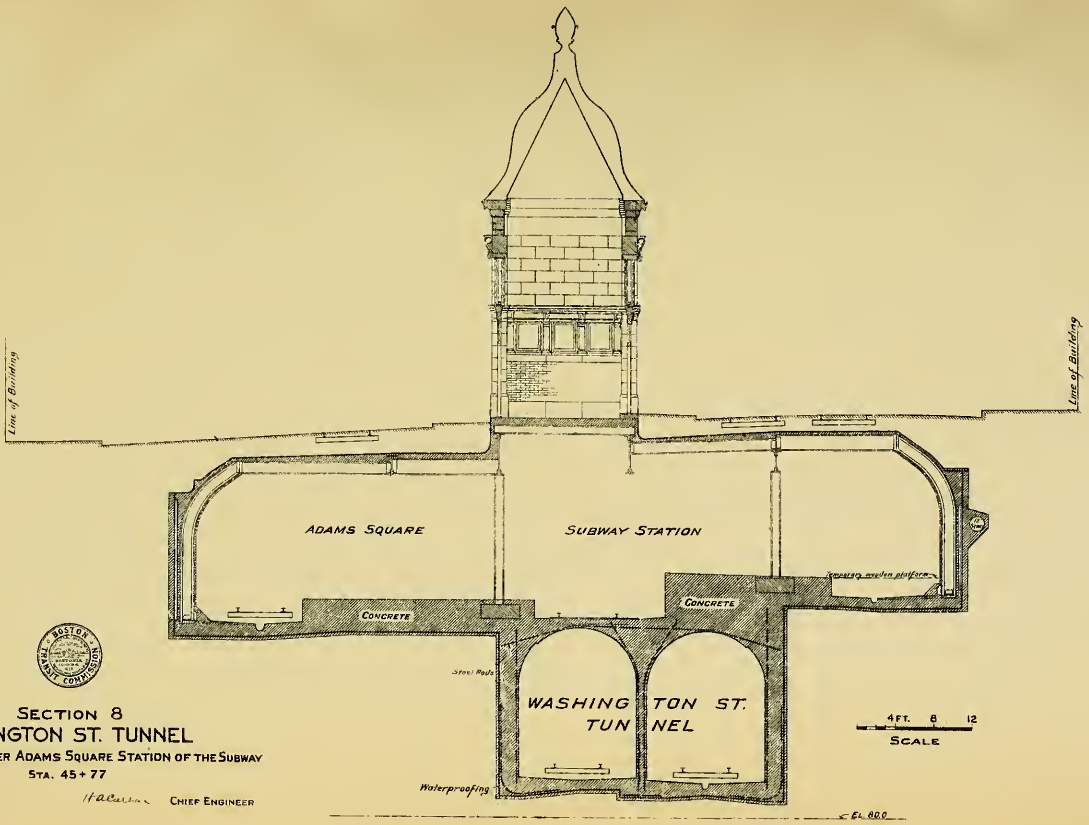


SECTION 5
WASHINGTON ST. TUNNEL
ENTRANCE AND EXIT AT CORNER OF WATER AND DEVONSHIRE STS.

H. A. Carson
CHIEF ENGINEER

HELIOTYPE CO., BOSTON.

PLATE 9.



BOSTON TRANSIT COMMISSION

SECTION 8
WASHINGTON ST. TUNNEL
CROSS SECTION UNDER ADAMS SQUARE STATION OF THE SUBWAY
STA. 45+77

H A Carson CHIEF ENGINEER

HELIOTYPE CO., BOSTON

completing the invert and center wall. The easterly side wall was constructed in advance of the westerly. The excavation for Section 5 was deeper than that of the preceding sections, varying from 30 to 48 feet. The concrete mixing was done by machine. The plant occupied an area of about 5,000 square feet in Post Office square until a section of tunnel was completed, when it was transferred to the tunnel near Ordway place, a section of arch being left open for this purpose. Hoppers just below the top of the arch received the cement, crushed stone, stone dust and sand through chutes from the street surface. Below the hoppers was a platform for gauging, and still lower, on the east invert, the mixer was placed. From the mixer the concrete was delivered into buckets on flat cars, from which the buckets were hoisted and dumped into cars running on the west invert. Electric power was used for the mixing and hoisting.

Underpinning of Buildings.—The underpinning done on this section includes the building fronts on the west side of Washington street from the northerly end of the section to the Post Building, and includes on the easterly side of Washington street the front of the Winthrop Building, the southerly pier of the Old South Building, the northwest corner and tower of the old South Meeting House and the fronts of buildings south of Franklin street. This work was done by Isaac Blair & Co. The so-called cantilever method was used in most cases. Heavy 15-inch I-beams were placed parallel and close to the building line, their ends being supported outside of the lines of the hole to be excavated. Other 15-inch I-beams, at right angles to the building line, were hung by heavy bolts from the former, with ends projecting under the pier. The other ends were then weighted, or fastened to the tunnel structure already in place, and upward pressure applied to the pier by turning up the bolts. With this preliminary support the buildings were underpinned without entering the basements.

Section 8 of the Washington-Street Tunnel.

NOTE.—See four tables following page 28.

General Description of Structure.—The structure consists of two arched passages, one for the north-bound and one for the south-bound track, separated by a center wall of steel and concrete. For a distance of 400 feet in Adams square the tunnel lies in whole or in part underneath the old Subway. See Plate 9. In order to depress the tunnel as little as practicable its roof and the floor of the Subway where the two are in common are heavily reinforced with steel and made as thin as is consistent with the requisite strength. The thickness from the base of the rail of the Subway to the intrados of the arch underneath is in some cases only a foot. Between Elm street and Hanover street the tunnel passes under the buildings on the easterly side of Washington street. The top of the tunnel in this locality is from four feet to seven feet below the level of the present basement floors.

Details of Construction.—Work was begun simultaneously at two points, respectively about 20 feet north and 85 feet south of Cornhill. Soon after, a pump well was started at Elm street, and the work of underpinning the buildings on the westerly side of Washington street, south of Cornhill, was commenced. The opening north of Cornhill having been excavated to its full depth, the concrete invert and westerly side wall were built, so as to allow of a plant for mixing concrete to be set up at that point. Work has been carried on in both directions from the pump well, in 16-foot lengths, the invert, walls, and arch being completed in turn.

Work under the old Subway is being carried on by excavating drifts, about 8 feet wide, on each side of the tunnel structure; a lower drift is driven first, followed by a drift immediately over extending to the underside of the old Subway. Back walls, 12 inches thick, are carried up against the outer side of the drifts to support the Subway while the main side walls are carried up to the springing line. The central core will be removed in short longitudinal sections, the building of the invert, center wall and roof following thereafter in the order named.

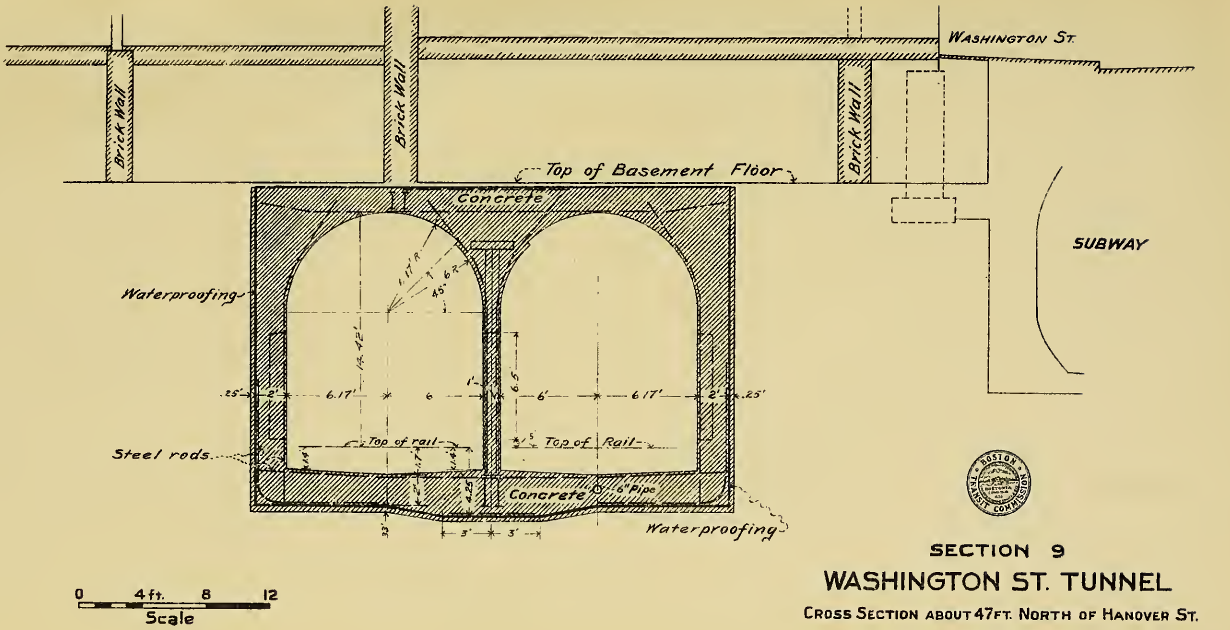
The underpinning of the buildings on the westerly side of Washington street, south of Cornhill, has been completed and the adjacent tunnel is being built to full width in 12-foot lengths. Work is also in progress under the block of buildings between Washington and Friend streets.

Section 9 of the Washington-Street Tunnel.

NOTE.—See four tables following page 28.

General Description of Structure.—The southerly end of the section for about 95 linear feet consists of two arched passages

PLATE 10.



SECTION 9

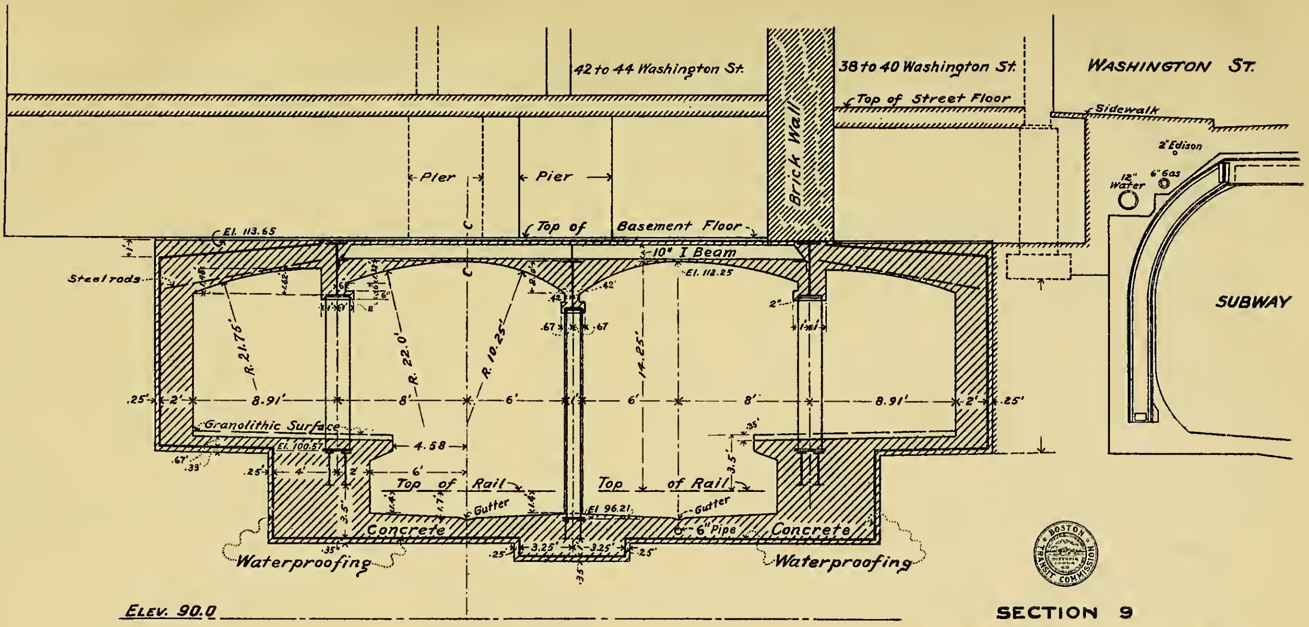
WASHINGTON ST. TUNNEL

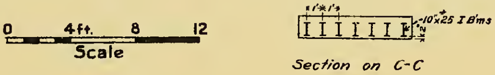
CROSS SECTION ABOUT 47 FT. NORTH OF HANOVER ST.

STA. 51 + 50

H. A. Carson CHIEF ENGINEER.

HELIOTYPE CO., BOSTON.





Section on C-C

BOSTON TRANSIT COMMISSION

PLATE II.

SECTION 9

WASHINGTON ST. TUNNEL

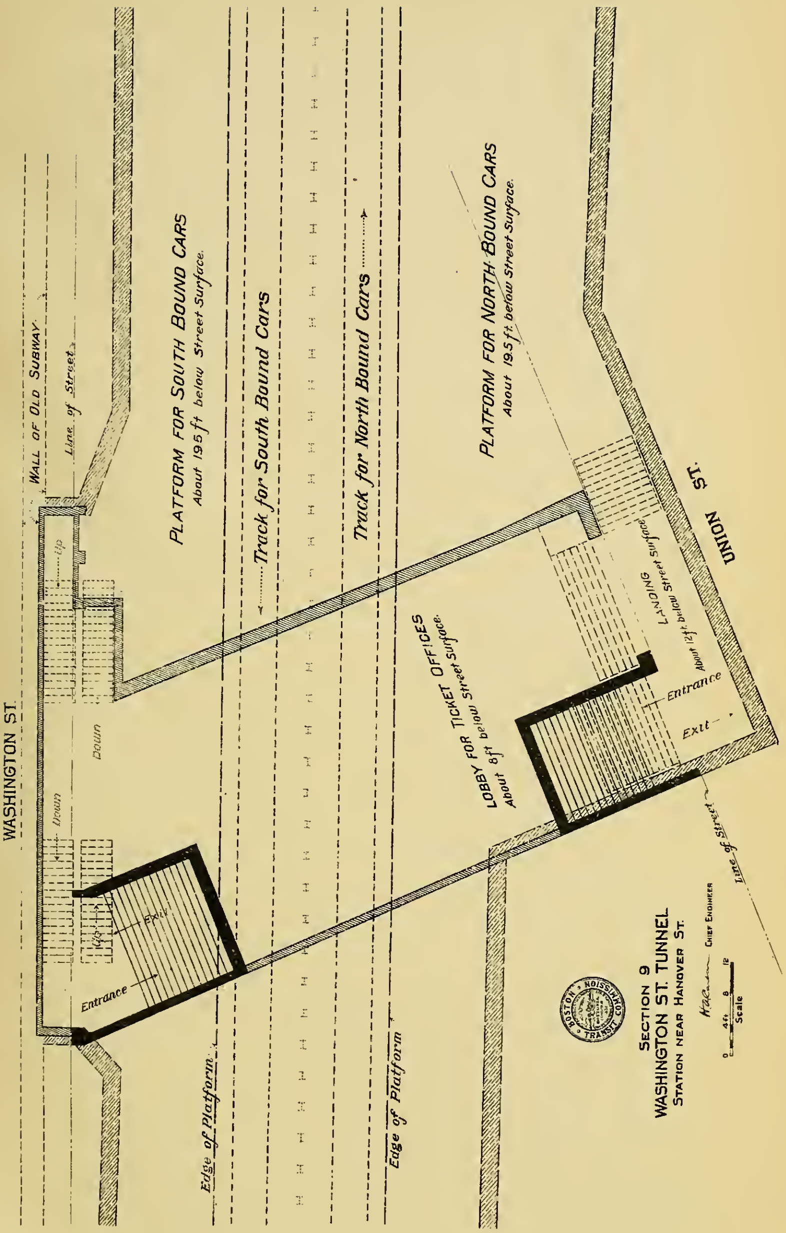
CROSS SECTION IN STATION ABOUT 116 FT. NORTH OF HANOVER ST.

STA. 52 + 19

H.A.Carson CHIEF ENGINEER.

HELIOTYPE CO., BOSTON.

PLATE 12.


WASHINGTON ST.
WALL OF OLD SUBWAY
Line of Street
Up
Down
Down
Up
Exit
Entrance
Edge of Platform
PLATFORM FOR SOUTH BOUND CARS
About 19.5 ft below Street Surface.
Track for South Bound Cars
Track for North Bound Cars
Edge of Platform
PLATFORM FOR NORTH BOUND CARS
About 19.5 ft below Street Surface.
LOBBY FOR TICKET OFFICES
About 8 ft below Street Surface.
LANDING
About 12 ft below Street Surface
Entrance
Exit
UNION ST.
Line of Street
0 4ft 8 12
Scale

SECTION 9
WASHINGTON ST. TUNNEL
STATION NEAR HANOVER ST.

H.A. Carson Chief Engineer

HELIOTYPE CO., BOSTON

—see Plate 10—similar to those referred to in the description of Section 8. The remainder of the section, a length of 350 feet, includes two opposite station platforms from 12½ feet to 24 feet in width—see Plate 11. The northerly end of each of these platforms is connected with the Subway by a sub-passageway. The entrance to this station will be through a lobby situated at about the level of the present basements. Stairways to this lobby will be from No. 30 Washington street and No. 90 Union street. The plan of this lobby and stairway is shown on Plate 12. The structure north of Hanover street lies almost wholly under the buildings between Washington and Union streets, its westerly wall being close to the easterly wall of the old Subway throughout.

Details of Construction.—Work was begun at the northerly end of the section. Up to the date of this report, June 30, 1906, a portion of the excavation has been done in Union street together with some work of underpinning under Shea's Liquor Saloon and under Peter Gray's Lamp Store, 90 Union street.

RELOCATION OF PIPES, SEWERS, AND OTHER UNDERGROUND OBJECTS.

Practically all the sewers, pipes, and electric conduits in Washington street, between Boylston street and Court avenue, have been relocated during the past year, and additional sewers have been built in several adjacent streets. Sewage has been carried in temporary pipes or boxes and various expedients have been adopted to maintain an uninterrupted service in the other structures during business hours. Water pipes which interfered with the tunnel structure have been relaid in advance of the roof construction; gas pipes have been cut out as soon as exposed, and replaced by temporary 3-inch steel pipes; and electric cables have been bared and bent up out of the way. Although the City Departments and public service corporations have been prompt to make these temporary changes and the contractors' operations have been greatly simplified thereby, the presence of these temporary structures, the tubes and cables of the Edison Electric Illuminating Company in particular, has seriously interfered with the laying of new pipes after the street has been backfilled.

All new locations have conformed to plans made by the Transit Commission; these have shown locations not only for such pipes as were ordered removed by vote of the Commission but also, where this has been possible, for such additional locations as the proper city authorities have seen fit to grant. Some degree of uniformity has been aimed at in this relocation, and, as far north as Franklin street, the general arrangement is as follows: Sewers are built on either side of the tunnel; electric conduits are laid deep in the gutter, passing below the catch basins, the electric lighting conduits on the west and those for telephones on the east side of the street; gas pipes are laid outside of and adjoining the street railway tracks, and water pipes are laid between the gas pipe and the telephone conduit, leaving a space between the conduits and the water pipes for service gates and manholes. A clear space is reserved at the proper depth for present and future fire pipes to all buildings.

At Summer street the cross pipes lie between the roof beams.

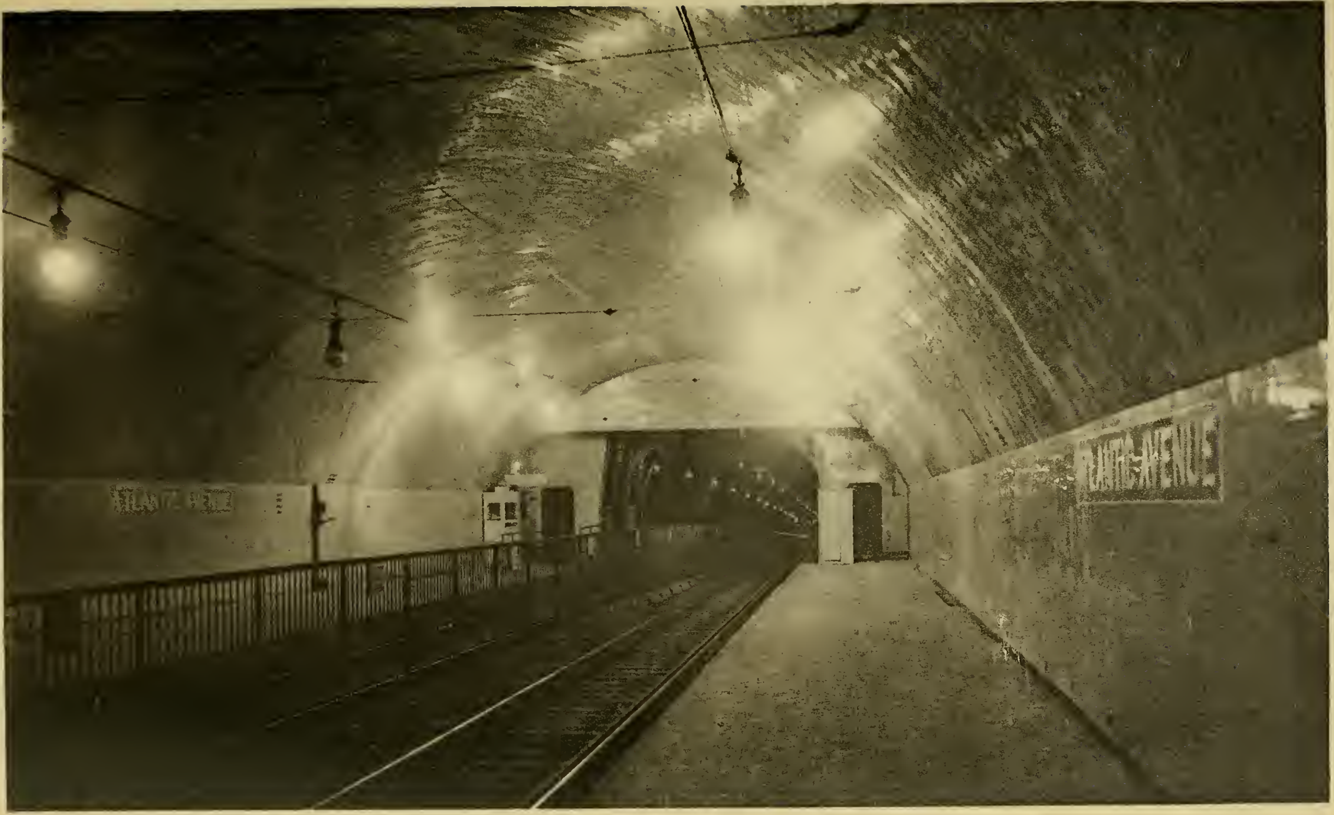
In assigning locations the interests of the City Departments, particularly those of the Water Department, have been especially considered. The water pipes are laid as far as possible from the street railway tracks to avoid danger from electrolysis and many of the bends and complicated connections on the old pipes have been eliminated in the new lines.

The pipes, sewers, and conduits as laid occupy practically all of the available space at most of the street intersections and little or no space is available for future additional pipes except underneath the tunnel.

The work of relaying the various underground objects has been carried on mainly during nights and Sundays. The vote of the Commission ordering relocations stipulates that "the work shall be carried on in such a manner as to leave the street open for traffic between the hours of 8 A. M. and 6 P. M.," and at the request of the Transit Commission many of the permits for additional work issued by the Street Department call for the additional work being done during nights or Sundays.

An exception to the general method of doing work occurred in the case of new water pipes laid in Washington street between Boylston and Water streets by the Water Department. An agreement between the Transit Commission and the former Water Commissioner was made in 1905, by which water pipes in Washington street were to be replaced by larger pipes laid under the temporary planking which then formed the surface of the street. About 100 feet of 16-inch pipe was laid at night

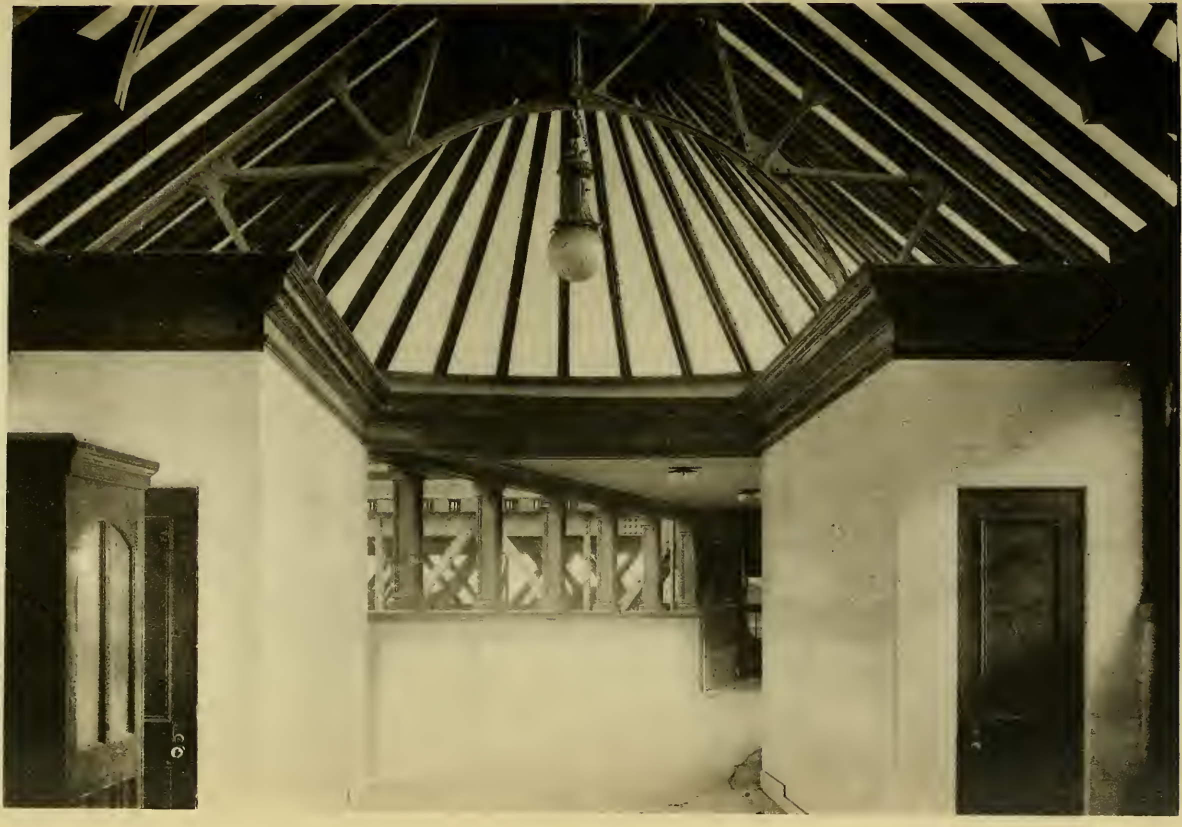
PLATE [illegible]



EAST BOSTON TUNNEL. LOOKING EAST IN ATLANTIC AVE STATION.

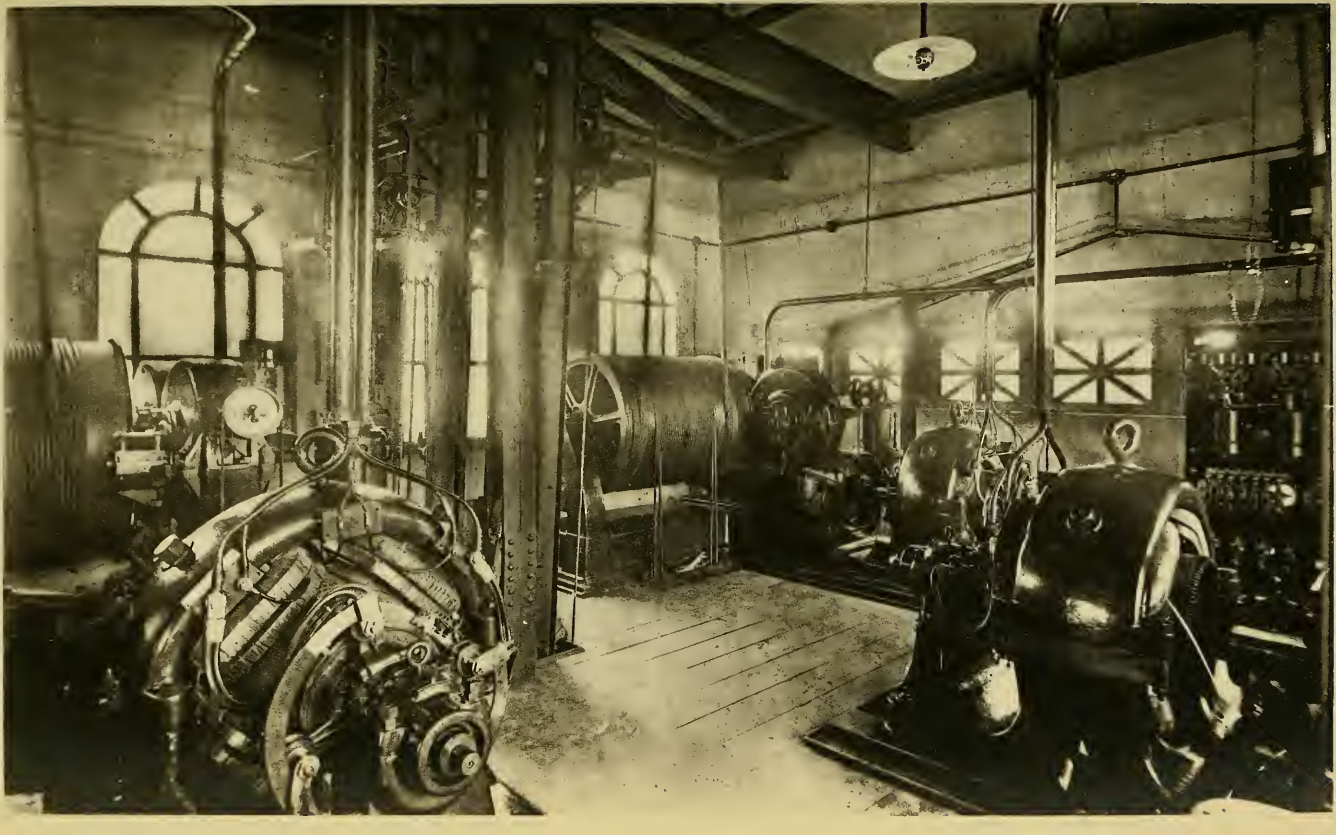
[illegible] PAINE BOSTON

PLATE 14.



EAST BOSTON TUNNEL. ATLANTIC AVE. STATION, LOOKING FROM STORY ABOVE THE STREET, SHOWING COVERED BRIDGE LEADING TO THE STATE ST. STATION FOR ELEVATED TRAINS IN ATLANTIC AVE

COCKAYNE, BOSTON



EAST BOSTON TUNNEL. MACHINERY LOFT FOR ELEVATORS IN ATLANTIC AVE. STATION.

COCKAYNE, BOSTON.

in this manner, from Bedford street running southerly, without disturbance to pedestrians or teams. At this juncture the work was stopped by the then Water Commissioner and the remainder was laid by his successor during the early summer of 1906, after Washington street had been filled in and repaved. From motives of economy the work was done largely during the daytime, the dirt being piled on the street and sidewalks. This is mentioned because many people attributed to the Transit Commission the condition which resulted.

The sewers along Washington street have been built by the Commission as part of the tunnel contracts and the same care not to disturb vehicles, pedestrians and other normal traffic has been taken as in the construction of the tunnel.

These pipes, conduits, and sewers have been continuously watched by a force of inspectors from the Water and Sewer Departments and from the Gas, Edison and Telephone Companies, amounting at times to over twenty men per day; their watchfulness, together with the contractors' care, has prevented any serious accidents either to person or to property due to the contents of these underground carriers.

EAST BOSTON TUNNEL.

Entrance to Atlantic-Avenue Station.

At the date of the last annual report the steel and concrete building over the easterly stairways and the elevators of the Atlantic-avenue Station were completed with the exception of some plastering and detail work. The four elevators, described on page 54 of the Tenth Annual Report, were completed during the past year, and were tested in January last. A special feature of these elevators is that the cars, while traveling a vertical distance of about 56 feet, have a horizontal travel of about 6½ feet. The reason for this is—as has been stated in a former report—that the station below has side platforms, while the entrance building above is in the middle of the street. The elevator cars run on curved guides, so arranged as to keep the car floors level at all times.

In the elevator tests, the plant successfuly complied with the following requirements: The cars carried the normal full load of 120 pounds per square foot of net floor area between the station platforms and the upper landing (69 feet rise) at the rate of forty round trips per hour with a maximum temperature rise of 40° C. in the motors and controller solenoids. The above rate was continued until the electrical apparatus attained a constant temperature. A car carrying the normal full load (represented by 6,000 pounds of iron cushioned on an ordinary bed mattress) was cut loose from the hoisting cables and allowed to drop. The travel before the safety clutches engaged was 12½ inches, with a total travel of 27½ inches before the car was brought to rest.

After the plant was taken over from the Transit Commission by the Elevated Railway Company, the latter installed pneumatic machinery for operating the gates. The station was opened for traffic April 5, 1906.

EXAMINATION OF THE TUNNEL.

A view of the station platform looking easterly towards the elevators is shown on Plate 13.

A view from the second story of the station above the street, looking towards the elevated railroad station, is shown on Plate 14.

A part of the machinery for operating the elevators is shown on Plate 15.

Examination of the concrete of the East Boston Tunnel has been made from time to time. In addition to surface inspection, four samples of concrete have been cut out. One of these was tested by hammer inspection and found to be excellent. Three were tested at the Watertown Arsenal and showed very satisfactory strength. Their resistance to compression was 4,360, 5,200 and 6,260 pounds per square inch respectively.

ASSISTANTS IN THE ENGINEERING DEPARTMENT.

The names of all who have been employed in the Engineering Department for more than one month during the last year are stated in Appendix D. As in former years, these assistants have given faithful and intelligent service.

Respectfully submitted,

H. A. CARSON,
Chief Engineer.

APPENDIX A.

REPORT TO THE LEGISLATURE ON THE DEVELOPMENT OF SUBWAY SYSTEMS.

BOSTON TRANSIT COMMISSION,
15 BEACON STREET, BOSTON, Jan. 19, 1906.

To the Honorable Senate and House of Representatives of the Commonwealth of Massachusetts in General Court assembled.

The Boston Transit Commission respectfully submits the following report, in compliance with chapter 48 of the Resolves of the year 1905:—

> *Resolved,* That the Boston transit commission shall forthwith proceed to inquire into the subject of the further development of the subway systems of the city of Boston; the most advisable routes; whether further subways are necessary or desirable at the present time, or will be in the immediate future; whether the further construction of such subways will be likely to endanger the stability of any surface structures now erected or to be erected; and such other details as said commission may consider necessary and relevant; and shall submit a report covering the results of said inquiry to the next general court not later than the third Saturday in January. [*Approved April* 13, 1905.

PUBLIC HEARING.

On Nov. 14, 1905, a public hearing was held at the rooms of the commission, upon the subject matter of the resolve. Various plans and suggestions were presented, orally and in writing, and others have been submitted since, the general opinion being that an enlargement of the subway system is necessary to keep pace with the growth of population and business.

DANGER TO BUILDINGS.

The resolve orders an inquiry as to whether the further construction of subways will be likely to endanger the stability of any surface structures now erected or to be erected.

Tunnelling is always dangerous. It is especially dangerous when carried on under or in immediate proximity to foundations of heavy buildings. To do the work safely in the streets of the city of Boston requires the best engineering skill and constant vigilance. The work which has already been done is the best evidence that it can be done with great assurance of safety. It is not probable that in the future there will be any conditions giving rise to greater difficulties than have been encountered and surmounted in the construction of the subway, the East Boston tunnel and the Washington Street tunnel.

The conclusion is that the danger to buildings is not such as to be a barrier to the further construction of subways.

The experience in London, following the opening of the Central London Railway, is of interest in this connection. Shortly after the road was put into operation some of the residents on the line complained of the vibration. In 1901 a committee of three eminent scientists and engineers was appointed by the Board of Trade to inquire into the matter. They satisfied themselves that vibration sufficient to cause serious annoyance actually existed in many cases.

It appeared that the trains had been hauled by electric locomotives on which the greater part of the weight was not supported by springs; and the committee recommended a different type of locomotive, in which the load not carried on springs should be reduced as far as possible. Modifications since made in this direction, and the use of the multiple-unit system, have practically eliminated all trouble from vibration in connection with the subways in London and in other cities.

THE GROWTH OF THE METROPOLITAN DISTRICT.

Although by the terms of the resolve the commission is to report only regarding transportation in Boston, it is evident that the traffic in the city depends upon the population of a much larger area. The problem is complicated in many ways. It is impossible to determine the distribution of traffic between the steam and the electric lines, and currents of traffic are continually varying in response to changing local conditions. The growth of the metropolitan district, however, would seem to be a reasonable indication of the traffic necessities.

Taking the cities and towns within a radius of ten miles from the State House together with the various wards of Boston, and dividing them into groups according as they are to the north, south and west of the centre of the congested district, the following results are obtained:—

TABLE I.—*Population.*

	North.	South.	West.	Total.
1895,	386,449	354,879	236,255	977,583
1905,	477,289	436,827	300,684	1,214,800
Per cent. increase,	23	23	27	24
1915,*	597,368	562,550	384,610	1,544,528
1925,*	762,387	764,900	497,250	2,024,537

Tables III., IV. and V., in the Appendix, give further details regarding the growth of population, and also the areas of the different cities, towns and wards of Boston, and the population per square mile. From these figures it seems probable that by 1915 the population in these three districts will have increased above that in 1905 by about 27 per cent., and that by 1925 it will have increased about 67 per cent.

GROWTH OF TRAFFIC.

It is the general experience that street railway traffic increases in greater ratio than the population; in other words, the greater the population, the greater the number of annual rides per inhabitant. The following table illustrates this point:—

---

* Estimated at the same rate of increase for each town or ward as between 1895 and 1905.

TABLE II.—*Relation of Trackage and Traffic to Population in the United States, in Groups of Urban Centres*, 1905.

	All Centres Over 500,000 Population.	All Centres of 100,000 but under 500,000.	29 Selected Centres of 25,000 but under 100,000.	49 Selected Centres of less than 25,000.
Total population served,	10,274,470	5,380,647	1,258,615	718,254
Miles of track,	4,998.89	3,559.82	951.93	485.95
Miles of track per 1,000 of population,	.49	66	.76	.68
Number of passengers,	2,456,542,270	994,327,853	135,842,312	49,179,495
Number of rides per inhabitant,	239.1	184.7	107.9	68.5

Regarding this subject, the following extract from the United States census report of 1902, on street and electric railways, from which the last table has been taken, is pertinent:—

"The comparative statistics of street railway traffic for urban centres of different sizes heretofore presented show clearly that the number of street railway rides tends to increase faster than population. This tendency is even stronger than the traffic statistics indicate, since in the largest cities the actual traffic, for reasons already indicated, does not equal the needs of the people. As a matter of fact, the relationship between street railway rides and population revealed in these figures is a necessary one. For, in the first place, it is evident that, as the city grows in population and area, a constantly larger proportion of its citizens must, or at any rate should, reside so far from their places of employment as to require means of transportation. Moreover, as the city grows, the distance which must be covered by the average passenger increases. Still another cause of this relationship is found in the fact that, as the population of a city increases, its individual citizen widens his social and economic circle, and needs to be put into connection with more people; hence he more frequently requires transportation."

In 1895 the total number of revenue passengers carried by the Boston Elevated Railway Company was 155,231,506; in 1905 it was 246,941,776. The metropolitan population in 1895 being 977,583, and in 1905 being 1,214,800 (as in Table I.), the number of revenue passengers carried by that company per inhabitant was 159 in 1895 and 203 in 1905,—an increase of 28 per cent. in ten years. If the same percentage of increase of revenue passengers per inhabitant should continue for the next two decades, the revenue passengers carried by the Boston Elevated Railway Company per inhabitant would be:—

In 1915,	261
In 1925,	334

Taking the number of revenue passengers per inhabitant above stated, and applying it to the assumed population given in Table I. for the years 1915 and 1925, the result will be:—

Revenue passengers in 1915,	394,000,000
Revenue passengers in 1925,	627,979,000

This result may be checked by direct estimate of the number of revenue passengers, based on the statistics of the Boston Elevated Railway Company for the past ten years. Thus:—

Revenue passengers carried in 1895,	155,231,506
Revenue passengers carried in 1905,	246,941,776
Per cent. of increase,	59

Estimated revenue passengers at same rate of increase will be:—

In 1915,	393,000,000
In 1925,	625,000,000

The figure for 1925 is very likely too large, for it is not probable that the rides per inhabitant will increase in the same ratio from 1915 to 1925 as from 1905 to 1915.

As the decade from 1895 to 1905 involved the opening of the subway and a somewhat sudden increase in traffic, more reliable figures may perhaps be obtained by taking the five-year interval beginning in 1900:—

Revenue passengers carried in 1900,	201,124,710
Revenue passengers carried in 1905,	246,941,776
Per cent. of increase,	23

The estimated number of revenue passengers at the same rate of increase will be:—

In 1910,	303,000,000
In 1915,	372,000,000
In 1920,	457,000,000
In 1925,	561,000,000

Although these figures are less than those previously obtained, as was anticipated, it is probable that, if increased facilities were given for transportation, as by the opening of new subways, the traffic would again increase with corresponding rapidity, as was the case upon the opening of the first subway.

The above computations are based upon the traffic of the Boston Elevated Railway Company alone. They do not include the traffic on the Boston & Northern and the Old Colony Street Railway and other lines in the metropolitan district, but they give probably a reasonable indication of the relative increase in traffic which may be expected.

As a result of this somewhat general investigation, it appears probable that in the next ten years the street-car traffic in Boston will increase normally some 60 per cent., and will double in from fifteen to twenty years.

Thus far reference has been made only to the total volume of traffic. One of the principal difficulties in dealing with the street-railway problem arises from the uneven distribution of the traffic during the day, and the concentration in the rush hours. The passengers who go to their daily occupations in the morning and return at night constitute a large proportion of the whole number. The flow of shoppers is fairly well distributed during the day, although the return tide of these frequently reaches its maximum almost at the close of business hours.

The proportion of traffic carried during the rush hour varies with local circumstances; but it is probable that in most large cities from 10 to 16 per cent. of the total daily traffic in either direction is carried during the hour of heaviest traffic in that direction. The recent investigations made by the Royal Commission on London Traffic indicate a maximum of about 16 per cent. during the rush hour; in other words, the number of passengers carried one way during the heaviest hour is about one-sixth of the total number carried daily in that direction.

This unequal distribution of the traffic is a serious problem of railway managers; but it does not affect the conclusions previously reached with reference to the estimated growth of traffic. The percentage carried during rush hours will probably not vary to any great extent, so that when the total traffic is doubled, the rush-hour traffic will be approximately doubled as well.

In addition to this estimated growth of traffic, it must be borne in mind also that additional facilities are needed for the traffic already existing.

In deciding upon what additional accommodations should be provided, it is an important question to what extent a street railway company should be required or expected to provide all of its passengers with seats during the rush hour. To do so fully would require a great increase in car equipment, a large part of which would be idle during most of the day. It would require a large number of extra employees, whose services would only be needed for a few hours. It would also require an increase in the number of tracks. in order to accommodate the additional cars necessary. The limit of crowding should certainly be well below that which now exists on some of the street railway lines in this city. The present traffic, therefore, calls for a considerable increase of service.

In laying out a plan for rapid transit, it is desirable to look ahead fifteen or twenty years. In the light of the estimates of growth which have been given, and the need of additional facilities to take care of the present traffic, it appears that the requirements of the problem are to foresee a plan which will provide for a volume of traffic at least double that now existing.

FACILITIES FURNISHED BY SUBWAYS ALREADY CONSTRUCTED OR AUTHORIZED.

Within the past ten years the Tremont Street subway has been put into operation. This, together with the construction of the elevated railway and the East Boston tunnel, probably doubled or more than doubled the transit facilities to the north, south and west. Yet the cars on all of these lines are now uncomfortably crowded in the rush hours, and not infrequently in the middle of the day.

East Boston Tunnel.

The original act, authorizing the construction of the East Boston tunnel (St. 1897, c. 500), as interpreted by the court, required the Boston Transit Commission, at some point within the limits therein defined, to make a connection between the tracks of the tunnel and the tracks of the subway. By St. 1902, c. 114, passed at the instance of this commission, it was provided that the East Boston tunnel and the Cambridge Street subway might be connected with the existing subway, and with each other, and with any other subway, on such terms, in such manner and at such points, whether at grade or otherwise, as the Boston Transit Commission might deem that the public interests require; but it was further provided that this could only be done with the consent of the Boston Elevated Railway Company. The purpose of the commission in seeking the passage of this act was to get authority to carry the tunnel tracks to a station under the present Scollay Square station. The Boston Elevated Railway Company did not consent thereto. The commission was therefore forced to construct the East Boston tunnel under the provisions of the original act, and to connect its tracks with those of the present subway. The result is, that when the train service is transferred to the Washington Street tunnel and the through tracks in the subway are restored to the use of surface cars, west-bound cars coming through the East Boston tunnel will cross at grade the track for north-bound cars in the subway.

This will reduce the capacity of the two tracks involved in the crossing. More than this, inasmuch as in a double-track system the number of cars passing in each direction is the same, this crossing at grade will reduce the capacity of the whole East Boston tunnel system and of the subway tracks north of Scollay Square. The volume of traffic may ultimately be such as to make it desirable to alter the section of the East Boston tunnel from the Old State House to Scollay Square, so that the tracks will not connect with the tracks in the subway, but will reach a station under the Scollay Square station, with a loop at that point around which the cars can pass for the return trip. Under this arrangement each track in the East Boston tunnel will be able to carry the full traffic which any track can carry, and the through tracks in the subway for their whole length will also have their full traffic capacity.

So long as the north-bound traffic at Scollay Square is split into two parts, one being the North Station traffic and the other the East Boston tunnel traffic, the sum of these two parts will not exceed 240 cars per hour; while if the suggested change is made, it will be possible to run 240 cars per hour to the North Station and also 240 cars per hour to East Boston, so that the sum of the two lines would then be 480 cars per hour.

Washington Street Tunnel.

A tunnel under Washington Street is now being built, under St. 1902, c. 534, and the acts in amendment thereof. It is believed that the amendatory act, St. 1905, c. 460, gives to the commission all requisite authority to deal successfully with the difficult problem of the construction of the tunnel from Adams Square north, without diminishing or otherwise injuriously affecting the traffic capacity of the original subway.

When this tunnel is completed, the train service now carried on the through tracks in the Tremont Street subway is to be transferred to it, and those tracks in the subway will revert to the use of surface cars from Shawmut avenue and Tremont Street, as originally planned and operated.

To relieve the present congestion on the surface of Washington, Milk and Congress streets, a considerable number of cars now running on those streets can then, either at Dover Street or farther south, be diverted to Shawmut Avenue, and thus into the subway. Columbus Avenue cars can also be brought into the Tremont Street subway by way of Chandler Street.

In the rush hours the crowding of passengers on the cars of the train service in the subway is excessive. The Washington Street tunnel is being built with station accommodations adequate for eight-car trains. In order to allow of the operation of such trains, however, the facilities at the elevated stations, and especially at the elevated terminals, must be considerably enlarged. Such trains will be sufficient to carry the present volume of rush-hour train traffic with comfort to passengers, and will make provision for some future growth.

Cambridge Subway.

By St. 1897, c. 500, § 5, the construction of a subway in and under Cambridge Street, Bowdoin Square and Court Street, to connect with the Tremont Street subway, was authorized whenever the Boston Elevated Railway Company makes request therefor and enters into an agreement for the use of the same. No request has been received. This act was amended by St. 1902, c. 114, as stated in the paragraph relating to the East Boston tunnel. Under this latter act it will be possible, with the consent of the company, to carry the Cambridge tracks to a loop terminal near the Scollay Square station, or under it, with or without connecting them there with the East Boston tunnel tracks. If it is desired to carry out any more material modification of the original plan, additional legislation may be needed, as it is doubtful whether the act of 1902 gives sufficient authority therefor. With out estimates of cost a definite plan for the connection of the Cambridge line with the subway system cannot be judiciously selected. In any event, for reasons similar to those set forth in treating of the East Boston tunnel, the commission is of the opinion that the cars of the Cambridge subway should not be brought onto the tracks of the Tremont Street subway.

The bridge over Charles River is now nearly completed, and the necessity for additional transportation facilities for Cambridge and points beyond is imperative.

The East-side Subway for Surface Cars.

So far as concerns the construction of the subway for surface cars, which was authorized by St. 1902, c. 534, the commission recommends that greater latitude of location be given. The act limits that part of the location which is south of the line of Court and State streets to the area bounded on the west by the existing subway, and on the east by a line parallel with and 750 feet easterly from Washington Street. If this subway is to pass over rather than under the East Boston tunnel, part of it must be located somewhat farther east than the present law permits. It seems expedient to authorize such action.

The clause in the act governing the time at which the construction of this subway is to be begun reads as follows:—

"The structure for the remaining two tracks, hereinafter called the subway, shall be begun at such time after the expiration of one year from the completion of the tunnel as the commission and the Boston Elevated Railway Company, hereinafter called the company, may agree upon, or, in case of difference, as the board of railroad commissioners, hereinafter called the board, shall determine that the public interests require. (St. 1902, c. 534, § 1.)"

The Washington Street tunnel will not be completed in less than a year and a half. Under the act, the construction of the subway for surface cars cannot in any event be begun until one year later, or until two and one-half years from the present time. In the case of this subway, as in the case of the tunnel under Washington street, the assent of the Boston Elevated Railway Company to all decisions of the commission upon important questions, whether relating to route, location of stations, methods of construction, plans or otherwise, is practically requisite, and in case of disagreement the company has an appeal to the Board of Railroad Commissioners. Under similar conditions it is not probable that the subway for surface cars can be completed in less than three years after construction is begun; so that, under the act of 1902, this subway will not be available for use at best before the expiration of five and one-half years from the present time. This period might be greatly extended if the commission or the company should not approve of beginning construction as soon as the law allows.

REQUIREMENTS AND AVAILABLE ROUTES.

In attempting to forecast the future, it must be recognized that a choice of routes, made under conditions existing to-day, may need modification when changes occur in those conditions. For instance, present calculations may be materially altered by the equipment of the suburban service of our steam railroads with electric power, or a change in the location of a steam railroad station, such as that which took place when the South Terminal was built, or other changes.

The effect of the provisions already made may be estimated as follows:—

Traffic North and South through the Centre of the City.

Running north and south from the heart of the city there are now four subway tracks,—two used for elevated trains of five cars, and two used for surface cars. There is also the Atlantic Avenue elevated line. When the Washington Street tunnel and the east-side subway are completed, there will be eight subway tracks,—two used for elevated trains of eight cars and six for surface cars. It follows that the subway and elevated provision for traffic north and south in the district between Boylston and Causeway Streets, which may be called the central district, will be more than doubled, and this amount of accommodation may be all that the present business and shopping district of the city will need. The streets and sidewalks of this portion of the city are so narrow and the congestion on them is so great that before traffic has doubled, business may be driven to the west and south-west, where it will have more room.

Traffic North to Charlestown and Points beyond.

As has been stated, when the Washington Street tunnel is completed, the eight-car train service in it will be able to accommodate comfortably the present rush-hour traffic to Sullivan Square, and provide for some future growth, but not for doubling the present traffic. On the Charlestown and Warren bridges the Boston Elevated Railway Company, and the Boston and Northern Street Railway Company now run together 148 surface cars in the maximum hour. This number of surface cars may be increased, but not doubled.

It is evident, therefore, that the volume of traffic to and from the north, under present legislation, is limited by the capacity of the Charles River bridges; and that, while the provisions already made will allow for a considerable increase in the traffic, they will probably not be sufficient to allow of its being doubled. They will, therefore, not relieve the present overcrowding and provide for the next fifteen or twenty years.

Provision for any further increase of traffic to the north, over that which is now authorized, can be made by a tunnel under the river, or by rebuilding and widening the Warren bridge, with a reservation for surface tracks. It is not unlikely that some additional provision for this traffic to the north will be needed in the not distant future.

The through tracks in the present subway, when restored to the use of surface cars, may be either brought to the surface at Causeway Street and there connected by a loop, or they may be connected by an underground loop. If brought to the surface and there connected by a loop, the capacity of the subway tracks will be much diminished by the grade crossings thereby introduced. If the through tracks are connected at the North Station by an underground loop, the inside tracks running to Scollay Square may be used to their full capacity without interference by grade crossings. Such a plan would allow of an extension of these through tracks under the river when the needs of the future call for such an extension.

Traffic to East Boston.

The number of cars now being run through East Boston tunnel in the maximum hour is 48. If the suggestion heretofore made with reference to the East Boston tunnel is adopted, a traffic five times as great can be carried through the tunnel. When this time comes it will not be difficult to make provision for a great increase in the tunnel traffic.

Traffic to the South.

There are now but two subway tracks leading directly to the south, these being used for the train service. When the Washington street tunnel and the east side subway are completed, the train service, being transferred to the Washington Street tunnel, will be able, as has been shown, to carry a larger traffic than at present, and there will be four additional subway tracks for surface cars.

The avenues to the south are such that there will be no difficulty in taking care of this subway traffic. They are reasonably wide and reasonably straight, and can be used for surface tracks or for extensions of subways or elevated lines, as circumstances may require.

When on the east side of Washington Street or in South Boston or Dorchester other facilities are needed than those furnished by the east side subway, into which South Boston cars may enter by way of the Broadway bridge, such facilities can be secured by an extension or branch of the Atlantic Avenue elevated line.

It is evident that the subways already authorized will provide for more than doubling the traffic accommodations toward the south, and should, therefore, meet the needs of the community for the next fifteen or twenty years.

Traffic to the West and South-west.

Craigie's or East Cambridge Bridge.—About one-half of the traffic from Craigie's bridge may be considered as going to the north and one-half to the west. The present number of cars in the maximum hour is 46. So far as the bridge is concerned, after the alterations which are now in progress are completed, traffic over it can be quadrupled without congestion. The limit of capacity on the Boston side will be reached sooner. Provision can then be made by means of a subway along the line of Leverett and Green streets to Bowdoin Square, or by connection with the elevated railway line, as conditions at that time may indicate to be best.

West Boston Bridge.—The rebuilding of the West Boston bridge and the provisions which have been made upon it for a rapid-transit line to Cambridge will more than double the traffic capacity on that bridge. The time of beginning of this Cambridge rapid-transit line is still uncertain.

Boylston Street.—On Boylston Street, from the entrance into the subway to Berkeley Street, there are now scheduled in the maximum hour 220 cars. Twelve of these cars come through Berkeley Street, 74 from Huntington Avenue, and the remaining 134 from Boylston Street beyond Copley Square. Of these, 12 come from the Ipswich Street line and the remainder from the Beacon Street, Commonwealth Avenue and Harvard bridge lines. There has been for some years serious congestion on Boylston Street between the mouth of the subway and Copley Square. There is also congestion, although less serious, on Massachusetts Avenue between Boylston Street and Beacon Street, and on Boylston Street near Massachusetts Avenue. The number of cars on Massacuhsetts Avenue between Boylston and Beacon streets in the maximum hour, including those which run south of Boylston Street, is 142.

The following observations are interesting in connection with this congestion. The destinations of the cars are Brookline, Mt. Auburn, Allston, Field's Corner, Cambridge, Broadway, Arlington Heights, Coolidge Corner, Putnam Avenue, Forest Hills, Newton, Oak Square, Reservoir, North Cambridge, Cross Town, Jamaica Plain, Western Avenue, Watertown, Waverley, etc.

Observations, Thursday, Nov. 23, 1905. *Weather Fine.*

Cars and other vehicles moving on Boylston Street, corner of Clarendon, between 4.50 and 6.30 P.M., 100 minutes:—

Cars going east,	339	
Cars going west,	332	
		671
Teams going east	92	
Teams going west	134	
		226
Automobiles going east,	34	
Automobiles going west,	41	
		75
Bicycles going east,	6	
Bicycles going west,	19	
		25
Total,		997

Averaging 9.97 per minute.

Estimated number of car passengers in 100 minutes, between 24,000 and 25,000, averaging over 240 per minute.

Observations of Number of Passengers and Speed, Friday, Nov. 24, 1905. Weather Fine.

Subway cars from Public Garden to Clarendon Street:—

Maximum passengers per car,		75
Seated,	32	
Standing,	43	
Minimum passengers per car,		35
Seated,	32	
Standing,	3	
Average passengers per car,		53
Seated,	32	
Standing,	21	
Maximum speed (miles per hour),		8
Minimum speed (miles per hour),		3.9
Average speed (miles per hour),		5.1

Clarendon Street to Public Garden:—

Maximum passengers per car,	34
Minimum passengers per car,	4
Average passengers per car,	20
Maximum speed (miles per hour),	7.4
Minimum speed (miles per hour),	3.6
Average speed (miles per hour),	4.9
Cars passing Boylston Street, corner of Arlington, in and out of subway incline in Public Garden daily,	4,598
Cars scheduled for maximum hour, in and out,	440
Averaging 7.33 per minute.	

This excessive overloading of cars on these lines is not confined to the rush hours of morning and evening, but is frequent in the middle hours of the day. It cannot be avoided while the trackage is limited as at present.

In the Appendix will be found a table giving the maximum number of cars per hour now scheduled to run on the various streets. As the maximum capacity of a track in the subway is about 240 cars per hour, and on the street, depending upon the team traffic, not properly over 160 per hour, it is clear that the traffic on Boylston Street has practically reached its limit.

What effect the construction of the Cambridge rapid-transit system to Scollay Square will have on the traffic over the Harvard bridge and Boylston Street is difficult to estimate. Many of the people coming from Cambridge will desire to go to points south of Scollay Square, and probably a large and increasing number of them will wish to reach Boylston Street and the neighboring streets toward the south and west, in which direction the shopping district is extending. These people will continue to come over Harvard bridge.

At present the traffic in the maximum hour over the West Boston bridge is 82 cars; and if this is doubled in the next fifteen years, it will in itself constitute a large traffic. The present number of cars passing over the Harvard bridge in the maximum hour is 76, although to accommodate the passengers the number should be considerably greater. By the time the Cambridge rapid-transit system is completed, the number of cars needed over Harvard bridge will be still greater, particularly as the traffic from Cambridge to Roxbury, South Boston and Dorchester, which passes over this bridge, will continue to increase.

Independent, therefore, of the Cambridge rapid-transit system, or of any increase in capacity and size of cars, it is evident that the needs of the present and immediate future require a very considerable increase in facilities for traffic towards the west. There are various ways in which additional facilities in this direction may be provided in greater or less degree, and they may be considered as follows:—

1. The present Boylston Street subway should be extended farther to the west. It will be possible to bring the tracks to the surface in Copley Square. Further study, however, may indicate that it will be desirable to carry the tracks still farther west. The Boylston Street tracks might be brought to the surface west of Exeter Street, the street being widened on the side of the Boston and Albany Railroad. The Huntington Avenue tracks could be carried under the Boston and Albany Railroad, and brought to the surface in the reservation opposite the Mechanics' Building. Whatever the details may be, the grades should be separated between the inward Boylston Street track and the outward Huntington Avenue track.

If this plan is adopted, and if all the cars from the west which now enter the subway continue to enter the subway, its effect would be to remove all but a small number of cars from Boylston Street east of Copley Square; but the number of cars running in the present subway would not be reduced. There would be still 208 cars scheduled in the maximum hour in the subway, 134 on Boylston Street west of the entrance, 74 per hour on Huntington Avenue and 142 on Massachusetts Avenue. Such a plan, therefore, would add but little to the capacity for traffic, though it would remove the congestion on Boylston Street.

The entrances, however, whether at Copley Square or west of it, might be so arranged that cars coming from Boylston Street or Huntington Avenue could either enter the subway or continue along the surface as far as Park Square. This plan would allow a large increase in capacity, since 240 cars per hour could be run in the subway and about 160 on the surface of Boylston Street without congestton, making a total of 400 per hour, as against 220 at present. The capacity of the Huntington Avenue tracks could be doubled; but the capacity of the Boylston Street tracks could not be doubled, on account of the congestion in Massachusetts Avenue, where there would still remain 142 cars per hour. If we take the reasonable capacity of a track on the surface as 160 cars per hour, this plan would therefore add little to the capacity of the Boylston Street tracks west of Copley Square. Something further is required to provide for the needs of the immediate future.

2. A new line may be built from the west, extending from near the junction of Beacon Street and Commonwealth Avenue under Commonwealth Avenue, or under one of the other streets between the river and Boylston Street, or under or on the proposed embankment, with a subway extension, to a new station at Park Street. This line would at first be used only for the cars running on Beacon Street and Commonwealth Avenue, which number is at present 66 in the maximum hour, but which should be greater to provide properly for present needs, and which should probably be doubled in a few years. Additional cars could be run upon this line from Brookline Avenue. The present eapacity of these routes would therefore admit of being trebled.

According to this plan, the number of cars in the present subway would be reduced to 142, the number on Boylston Street between Church and Berkeley streets to 154, between Berkeley Street and Copley Square to 142, between Copley Square and Massachusetts Avenue to 68, and on Massachusetts Avenue to 76. This plan would therefore allow of a large increase in the capacity of the Beacon Street, Commonwealth Avenue and Brookline Avenue lines. On account of the large number of cars remaining on Boylston Street between Church and Berkeley streets, however, it would not allow of a very large increase of the number of cars on Boylston Street, which would have been reduced by only 66.

3. This difficulty would be overcome if both suggestions above made are carried out. The present traffic would then load the various tracks as follows:—

	Cars per Hour.
On the new line from the west,	66
In the present subway, about	130
On Massachusetts Avenue,	76
On Boylston Street, between Massachusetts Avenue and the subway entrance,	68
On Huntington Avenue,	74

It is plain that this would, on the whole, more than double the capacity toward the west, at the same time removing almost all the cars from the surface of Boylston Street east of Dartmouth Street, and would be the best and most comprehensive plan.

A further reason for the construction of this new line is the congestion at the Park Street station, which has already passed its proper limit.

Such a line would carry the traffic from Brookline, Newton, Brighton and parts of Cambridge, Watertown and Waltham, and would leave the Boylston Street subway for the traffic from Campridge, Ipswich Street and Huntington Avenue.

If a new subway from the west should be constructed under Commonwealth Avenue, it would be nearly an air line from end to end. The stairway coverings should be small structures in the mall, there would be no underpinning of buildings, no real estate damages for stations, and comparatively little relocation of pipes, sewers and other underground structures, and it would therefore be an economical subway to construct.

Further engineering study will be necessary in order to determine definitely the relative merits of these routes.

When, in the more distant future, the traffic entering the present Boylston Street subway is increased to such an extent that further relief is desirable, the Huntington Avenue traffic could be diverted in a new subway, indicated on plan No. 1, extending under St. James Avenue to Providence Street and thence to Park Square; there the tracks may be looped back or into Columbus Avenue, or they may be connected with the Columbus Avenue tracks by a longer loop, running past the South Terminal via Eliot and Kneeland streets, Atlantic Avenue, Winter and Summer streets and the Common.

Cross-town Lines.

The East Boston tunnel furnishes one cross-town line, making connection between the present subway, the Washington Street tunnel and the elevated Atlantic Avenue line. There is considerable call for another cross-town line farther to the south. This demand can be met at any time by means of a deep tunnel passing under the north and south lines, having footway connections with stations on those lines. There are two obvious routes for such a cross-town line. One is under Summer and Winter streets, which might be a part of a line under the Common to the west, or a part of the proposed Cambridge rapid-transit development. The other is a line from Park Square, either under Boylston Street and Essex Street or Eliot and Kneeland streets, or in the line of Beach and LaGrange streets to the South Terminal. This line could have extensions to the west and southwest under Columpus Avenue or Huntington Avenue. Such a cross-town line as either of the above would be efficient in knitting together the lines of subway and elevated traffic, and would undoubtedly prove of great convenience to the public.

RELIEF OF STREETS FROM CONGESTION.

The problem of transit in cities consist not only in providing means of transportation, but also in relieving the streets from the increasing congestion which is sure to come with increasing population. In the case of Boston the second problem is of almost equal importance with the first. The narrowness of the streets and sidewalks gives rise to a condition of things which is at times and in certain places insufferable. It was estimated ten years ago that 100,000 tons of freight were transported daily through the streets of Boston. Since this estimate was made, the volume of this traffic has probably increased from one-fourth to one-third.

The most effective method of relieving the congestion of the streets is by placing the street cars in subways. This removes from many streets a large proportion of the vehicles from the surface, and is a powerful argument in favor of proceeding with the construction of subways as fast as the needs of transportation require, until the street cars shall be almost or entirely removed from the streets in the business or congested portions of the city. The subways already authorized, and those herein suggested, will allow various surface tracks to be removed. Sidewalks can therefore be wideded, and the merchandise traffic of the city much benefited.

CONCLUSIONS.

The conclusions at which the commission has arrived may be summarized as follows:—

First.—The subways already authorized will provide sufficiently for the reasonable needs of the future so far as concerns the traffic toward the south.

Second.—The subways already authorized will provide for a considerable increase in the traffic capacity towards the north. The capacity of the bridges will limit the traffic in this direction.

Third.—In order that all tracks may be used to their full capacity, the East Boston tunnel tracks should not be permanently connected at grade with the present subway tracks at Scollay Square, thereby diminishing by one-half the capacity of its own tracks and that of the through tracks in the present subway north of that point; but eventually these East Boston tunnel tracks should either end in a loop under Scollay Square station, or be extended to the west as a part of some through east and west line.

Fourth.—The act providing for the east side subway should be amended so as to allow that subway to be built at a greater distance from Washington Street, so that it may pass over rather than under the East Boston tunnel.

Fifth.—The Cambridge Street subway should not be connected at grade with the Tremont Street subway, but should either end in a loop or form part of some through line to the east. If ending in a loop, further study may indicate that it is desirable to carry this subway to the neighborhood of Park Street.

Sixth. Additional provision should be made without delay for the traffic towards the west. The commission recommends that the Boylston Street subway be extended immediately to Copley Square or to some other point or points farther west, as further study may determine, separating the grades of the Boylston Street and Huntington Avenue tracks. The commission also recommends that a new line be constructed from near the junction of Commonwealth Avenue and Beacon Street to Park Street.

Seventh.—In laying out any comprehensive subway or elevated transportation system, the endeavor should be to avoid crossings at grade. Every such crossing reduces the traffic capacity of the tracks involved. The construction of a subway or an elevated road is so expensive that the capacity should be kept, if possible, at a maximum. Furthermore, stub ends should be avoided if practicable, and loops should be provided, which do not reduce the capacity of the tracks.

Eighth.—The danger to surface structures now erected or to be erected is not such as to be a barrier to the further construction of subways.

The Tremont Street subway and the East Boston and Washington street tunnels are the beginnings of a comprehensive system. The east-side subway, the Cambridge Street subway, the suggested Boylston Street extension and the suggested Commonwealth Avenue subway are progressive parts of this system. If economically built and equitably leased, they should prove profitable investments in the field of transportation, and should not add to the taxes or the ultimate debt of the city.

Three plans are presented herewith. Plan No. 1 shows the present subways and elevated lines; the subways already authorized by the Legislature, the suggested extension of the Boylston Street subway; a subway under Commonwealth Avenue to Park Street; and for the more distant future a subway connecting the Huntington avenue and Columbus Avenue tracks by a loop passing the South Terminal *via* Eliot, Kneeland, Summer and Winter streets.

Plan No. 2 shows a Charles River embankment line.

Plan No. 3 shows the present subways and elevated lines; the subways already authorized by the Legislature, with a route from Oak Street, south, *via* Custom House to Charlestown bridge, north; the extension of the Boylston Street subway to Copley Square, a subway under Commonwealth Avenue to Park Street; and a connection from Park Street, *via* Winter and Summer streets, to the South Terminal.

In making this report, the commission has received valuable information or assistance from the Boston Elevated Railway Company, the Boston & Northern Street Railway Company, the Old Colony Street Railway Company, Mr. Howard A. Carson, its chief engineer, and Mr. B. Leighton Beal, its secretary.

GEORGE G. CROCKER,
CHARLES H. DALTON,
THOMAS J. GARGAN,
GEORGE F. SWAIN,
HORACE G. ALLEN,
Boston Transit Commission.

APPENDIX.

TABLE III.—*Population served towards the North.*

CITY OR TOWN.	Population, 1895.	Population, 1905.	Increase (Per Cent).	Area (Square Miles).	Population per Square Mile. 1905.	Total, 1915.	Population. 1925.
Boston, Ward 6,	27,860	29,987	7.64	.4575	65,545	32,300	34,800
Boston, Ward 5,	12,986	12,653	—2.56	.3130	40,425	12,300	11,950
Boston, Ward 4,	13,375	12,499	—6.55	.4700	26,589	11,580	10,750
Boston, Ward 3,	13,943	14,831	6.36	.5180	28,631	15,650	16,600
Boston, Ward 2,	21,588	25,929	20.10	.5575	46,518	31,100	37,300
Boston, Ward 1,	21,007	25,405	20.93	1.8550	13,695	30,600	36,900
Chelsea . .	31,264	37,289	19.27	5.5400	6,730	44,500	53,000
Everett, . .	18,573	29,111	56.73	3.7500	7,763	45,600	71,500
Lynn, . .	62,354	77,042	23.55	11.2200	6,866	95,000	117,000
Malden, . .	29,708	38,037	28.03	5.1300	7,414	48,500	62,000
Medford, .	14,474	19,686	36.00	8.8000	2,237	25,800	35,000
Melrose, . .	11,965	14,295	19.47	4.8000	2,977	17,100	20,400
Nahant, . .	865	922	6.60	1.0600	869	982	1,045
Revere, . .	7,423	12,659	70.53	6.3200	2,003	21,600	36,800
Saugus, . .	4,497	6,253	39.00	11.5800	540	8,007	12,001
Somerville, .	52,200	69,272	32.70	4.1200	16,813	91,500	121,000
Stoneham, .	6,284	6,332	.76	6.6500	951	6,356	6,392
Swampscott, .	3,259	5,141	57.80	3.0900	1,663	8,100	12,800
Wakefield, .	8,304	10,268	23.60	7.8900	1,301	12,700	15,700
Winchester, .	6,150	8,242	34.01	6.2700	1,314	11,000	14,750
Winthrop, .	4,192	7,034	67.80	3.8000	1,851	11,800	19,800
Woburn, .	14,178	14,402	1.57	13.1100	1,098	14,600	14,800
Totals, .	386,449	477,289	–	–	–	596,675	762,288

TABLE IV.—*Population served towards the South.*

CITY OR TOWN.	Population, 1895.	Population, 1905.	Increase (Per Cent.).	Area (Square Miles).	Population per Square Mile, 1905.	Total, 1915.	Population, 1925.
Boston, Ward 24,	18,240	31,650	73.52	5.0800	6,234	54,700	94,900
Boston, Ward 23,	18,283	26,410	44.45	11.9000	2,219	37,700	54,200
Boston, Ward 22,	22,289	27,769	24.59	1.1900	23,335	34,400	42,700
Boston, Ward 21,	19,274	26,533	37.66	1.0000	26,533	36,400	50,000
Boston, Ward 20,	21,528	41,805	94.19	2.6800	15,598	80,800	156,500
Boston, Ward 19,	22,372	29,213	30.58	1.1900	24,548	38,000	49,500
Boston, Ward 18,	21,679	22,121	2.02	.3440	64,305	22,520	23,000
Boston, Ward 17,	21,114	24,313	15.15	.6610	36,721	27,800	31,800
Boston, Ward 16,	16,320	21,924	34.34	.8820	24,858	29,300	39,200
Boston, Ward 15,	18,623	20,310	9.07	.3795	53,518	22,400	24,600
Boston, Ward 14,	19,186	22,127	15.33	.6020	36,755	25,500	29,400
Boston, Ward 13,	24,900	21,654	—13.04	.9440	22,937	18,700	16,200
Boston, Ward 12,	21,591	21,738	.68	.3670	59,231	22,000	22,200
Boston, Ward 10,*	11,277	11,921	5.71	.6150	19,383	12,600	13,300
Boston, Ward 9,	23,174	22,120	—4.55	.2910	76,013	20,800	19,700
Boston, Ward 7,	16,973	15,579	—8.21	.6150	25,331	14,200	13,000
Hyde Park, .	11,826	14,510	22.73	4.5800	3,168	17,730	21,700
Milton, . .	5,518	7,054	27.83	13.2000	541	9,000	11,500
Quincy, . .	20,712	28,076	35.50	16.6400	1,687	38,000	51,500
Totals, .	354,879	436,827	–	–	–	562,550	764,900

* One-half of the ward.

TABLE V.—*Population served towards the West.*

CITY OR TOWN.	Population, 1895.	Population, 1905.	Increase (Per Cent.).	Area (Square Miles).	Population per Square Mile, 1905	Total, 1915.	Population, 1925.
Boston, Ward 25,	15,001	21,806	45.36	4.280	5,094	31,700	46,000
Boston, Ward 11,	19,930	22,353	12.15	.997	22,420	24,800	27,600
Boston, Ward 10,*	11,277	11,920	5.70	.615	19,383	12,600	13,300
Boston, Ward 8,	23,130	30,810	33.20	.259	118,957	40,800	54,400
Arlington, .	6,515	9,668	48.39	5.540	1,745	14,350	21,300
Belmont, . .	2,843	4,360	53.30	4.650	938	6,700	10,270
Brookline, .	16,164	23,436	44.98	6.820	3,436	34,000	49,300
Cambridge, .	81,643	97,434	19.34	7.150	13,627	116,000	138,000
Lexington, .	3,498	4,530	29.50	16.630	272	5,860	7,580
Newton, . .	27,590	36,827	33.47	18.640	1,975	48,700	64,800
Waltham, .	20,876	26,282	25.89	13.520	1,944	33,000	41,500
Watertown, .	7,788	11,258	42.85	4.170	2,700	16,100	23,200
Totals, .	236,255	300,684	–	–	–	384,610	497,250

* One-half of the ward.

TABLE VI.—*Cars in the Maximum Hour (P.M.) in Certain Sections, radiating from the Centre of the City, and from the Elevated Terminals and Ends of the Subway.*

From centre of the city:—	Maximum Each Way.
Passing through Dewey Square, ...	111
Dorchester Avenue, Summer Street to Broadway, ...	77
Washington Street, Cornhill to Summer Street, ...	94
Washington Street, Summer Street to Boylston Street, ...	115
Washington Street, Boylston Street to Northampton Street, . . .	51
Washington Street, Adams Square to Hanover Street, north, . . .	180
Washington Street, Adams Square to Hanover Street, south, . . .	104
Tremont Street, Washington Street to Roxbury Crossing, ...	46
Columbus Avenue, Park Square to Berkeley Street, ...	24
Columbus Avenue, Burkeley Street to Northampton Street, . . .	26
Huntington Avenue, Copley Square to Massachusetts Avenue, . . .	74
Boylston Street, Church Street to Berkeley Street, ...	220
Boylston Street, Berkeley Street to Copley Square	208

TABLE VI.—*Cars in the maximum hour, etc.*—Concluded.

	Maximum Each Way.
From centre of the city:—	
Boylston Street, Copley Square to Massachusetts Avenue,	134
Massachusetts Avenue, Boylston Street to Beacon Street,	142
Beacon Street, Massachusetts Avenue to Commonwealth Avenue,	66
Beacon Street, Commonwealth Avenue to Coolidge Corner,	28
Commonwealth Avenue, Beacon Street outward,	38
Over bridges:—	
Harvard bridge,	76
West Boston bridge,	82
Craigie bridge,	46
Charlestown bridge, new	83
Charlestown bridge, old,	11
Sullivan Square terminal (upper and lower):—	
Passing over Broadway, between Terminal and Cross Street,	108
Passing over Alford Street bridge,	119
Dudley Street terminal (upper and lower):—	
At Dudley Street, corner Warren Street,	164
Via Warren Street,	84
Via Dudley Street, east,	80
At Dudley Street, corner Washington Street, north,	93
At Dudley Street, corner Washington Street, south,	119
Via Washington Street	52
Emerging from the subway:—	
At Public Garden (Boylston Street),	208
At North Station (Causeway Street),	85

APPENDIX B.

AN ACT TO EXTEND THE TERM OF OFFICE OF THE MEMBERS OF THE BOSTON TRANSIT COMMISSION.

[STAT. 1906, CHAP. 213.]

Be it enacted, etc., as follows:

SECTION 1. The term of office of the members of the Boston transit commission is hereby extended for three years from the first day of July in the year nineteen hundred and six.

SECTION 2. The powers, duties and compensation of said commission during said term of three years shall be the same as are specified in chapter five hundred and forty-eight of the acts of the year eighteen hundred and ninety-four and in acts in amendment thereof or in addition thereto; and any vacancy occurring in said commission shall be filled in the manner provided in said chapter five hundred and forty-eight. Said compensation and the expenses incurred by said commission shall be paid as provided in said chapter five hundred and forty-eight and in acts in amendment thereof or in addition thereto.

SECTION 3. This act shall take effect upon its passage. [*Approved March* 30, 1906.

APPENDIX C.

AN ACT TO AUTHORIZE THE BOSTON ELEVATED RAILWAY COMPANY TO CONSTRUCT A SUBWAY OR SUBWAYS IN THE CITY OF CAMBRIDGE AND TO PROVIDE FOR CONNECTION THEREOF WITH THE RAILWAY SYSTEM IN THE CITY OF BOSTON.

[Stat. 1906, Chap. 520.]

Section 23. Section fifteen of chapter five hundred of the acts of the year eighteen hundred and ninety-seven is hereby so far amended, that the company shall not erect any elevated structure upon its elevated railway location over the new Cambridge bridge, except so far as may be necessary or convenient to make a suitable connection at the easterly terminus thereof with its elevated railway structure, if any, on the location hereinafter described, and its tenure thereof or other rights shall not be impaired by omission so to do; nor shall it be required to apply for the elevated railway route between Boston and Cambridge, described in said section fifteen, within six months after the time when such bridge is finished, nor to construct its elevated railway thereon; but in lieu thereof it is hereby authorized and required to construct and complete its elevated railway, within the time allowed for completion of the Main street subway herein provided for, upon and over one of the routes in the city of Boston here designated, namely: (1) between Scollay square and North Russell street, or the westerly terminus of the subway authorized by section five of said chapter five hundred if extended nearer to Charles river than said street, in and through such subway if built, and thence, if such subway is not extended to such new bridge, upon and over its location granted by chapter five hundred and forty-eight of the acts of the year eighteen hundred and ninety-four, in and through Cambridge street and Charles street and in and over any intervening public or private ways or lands to such new bridge; or, (2) between the Park street subway station and a point between Pinckney and Cambridge streets or in Cambridge street or at or near such new bridge, in and through a tunnel for two railway tracks adapted to the use of elevated railway trains and surface cars, with suitable appurtenances and terminals, which the Boston transit commission is hereby authorized to construct, upon the request of the company as hereinafter provided, upon such route as the commission may determine, in and under any public or private ways or lands between such points; and thence, if such tunnel is not extended to such new bridge, upon and over a location hereby granted in, through and over such street or streets or other public or private lands as the company may deem suitable for such route, to such new bridge, or to Cambridge street and thence over the location (1) aforesaid to such new bridge; and, from the westerly terminus of either route, upon its location across such new bridge and in Main street in Cambridge to a connection with the Main street subway.

Within six months after its acceptance of this act the company shall request the commission to construct such subway or such tunnel, and the commission shall thereupon determine which of such structures, shall be constructed, and shall give the company written notice of such determination; and if the company is dissatisfied therewith, it may within thirty days after such notice apply to the board for a revision thereof, and thereupon the board may consider and finally determine the question; and the commission shall proceed, as soon as may be, with the work of construction.

If the subway hereinabove referred to is constructed, it shall be constructed, except as otherwise expressly provided herein, in the manner and under the terms and conditions prescribed by said section five of said chapter five hundred.

If the tunnel hereinabove described is constructed, it shall, except as otherwise expressly provided herein, be constructed and paid for upon and under the same terms, conditions and provisions, so far as the same are applicable, and with the same rights, powers and priviledges in respect of the construction thereof, which rights, powers and privileges are hereby conferred for such purpose upon the commission, the board, the city of Boston and its treasurer, the company, and other public officers or parties in interest respectively, including any persons sustaining damages by the taking of or injury to property by the commission under authority thereof, as are prescribed by chapter five hundred and thirty-four of the acts of the year nineteen hundred and two for construction of the tunnel therein provided for; including the rights and powers conferred by section thirteen of said act, which section shall also apply to the location of the tunnel and to the construction of the subway referred to in this section if that is constructed.

If the construction of the subway or tunnel upon the route determined upon requires such a permanent cut in any street as to necessitate the widening thereof, or if the construction in connection with the subway or tunnel of an incline from the elevated railway structure to the surface in any street necessitates the widening thereof, the commission may take or purchase lands for such necessary widening, which shall not exceed thirty feet on each side nor extend less than thirty nor more than one hundred feet beyond the ends of such open cut or incline, and may construct a highway thereon; and the cost thereof, including all compensation or damages for property taken or purchased therefor, shall be repaid by the company to the city of Boston, with interest at four per cent per annum from the time of expenditure to the time of repayment.

Any tunnel construction under or within one hundred feet from Boston common shall be, so far as practicable, water-tight, and the work shall so be done as to avoid the draining of moisture from the surrounding soil or other injury to trees. No additional structures shall be placed above the surface of the common, but in connection with the construction of the tunnel the commission may enlarge, by not more than one third, the width of the existing entrances to and exits from the Park street subway station, and the cost thereof shall be deemed and treated as part of the cost of the tunnel.

Upon or before completion of the work the commission shall execute with the company, in the name of the city of Boston, a contract for the sole and exclusive use of the subway or tunnel and its appurtenances and terminals by the company, for the running of its elevated trains and surface cars therein and for other purposes, for a term of not less than twenty years from its opening for use, at an annual rental equal to four and seven eighths per cent of its net cost, including therein interest at four per cent per annum on the debt incurred in construction prior to the beginning of the use, and containing in substance the additional car tolls compensation clause, and the provisions relating to the city's police and fire-alarm wires and apparatus, of the subway lease dated December seventh, eighteen hundred and ninety-six, and such other provisions and conditions, following the form of the lease of the Washington street tunnel dated September twenty-fifth, nineteen hundred and two, so far as the same are applicable, as the commission and the company may agree upon, or in case of difference as the board may determine.

APPENDIX D.

The names of all the assistants in the Engineering Department who have been employed for more than one month during the last year, together with an indication of the work on which they have been engaged, are given below. Those marked * left the employ of the Commission during the year.

OFFICE ASSISTANTS, JUNE 30, 1906.

Assistant Engineers.

EDMUND S. DAVIS,	Oversight of office and field work.
WILLIAM W. LEWIS, WILLIAM O. WELLINGTON, *HARRY S. R. MCCURDY,	Studies, preliminary estimates, designs for structures and contract plans.
RALPH H. STEARNS,	Line and grade work, Section 5; office studies for structures.
GEORGE H. STEARNS, RUSSELL L. ELLIOT, CHARLES H. BARTLETT, AUSTIN M. EVERETT,	Designs and drawings for steel work[†] and concrete structures.
G. DANA EMERSON,	Miscellaneous work, including designs for structures for ventilation, pumping, etc.

Draughtsmen, etc.

LEONARD B. HOWE, *JOHN J. BURNS, WILBUR W. DAVIS, EDMUND A. RICE,	Plans for tunnel work and structures.
EDWIN L. REED,	Architectural work, designs for station entrances and changes in buildings.
*EDWARD F. ATWOOD,	Plans for steel work and tunnel structures.
*WALTER L. PERRY,	Lettering and tracing.
WILLIAM H. BELL, FREDERICK F. MURPHY	Rodmen; tracing, etc.
FREDERICK W. STILES,	Photographer and assistant for purchasing supplies.

[†] The plans for the steel for a portion of Section 10 were made in the office of Joseph R. Worcester, Consulting Engineer.

PIPE CHANGES.

LAURENCE B. MANLEY,	Assistant Engineer; field and office work.
*JOHN M. GLEN, Transitman JOHN J. HURLEY, Rodman,	Laying out and inspecting work in streets.
ERNEST M. CROWLEY,	Making plans in office for changes.

FIELD ASSISTANTS.

Patrick F. O'Brien,	Assistant Engineer, Sections 1, 5 and 9.
Robert B. Farwell,	Assistant Engineer, Sections 2, 3 and 8.
*Leonard L. Street,	Assistant Engineer, Sections 3 and 4.
*Clifford R. Fancy,	Transitman, Section 1.
Charles P. Loveland,	Transitman, Sections 2, 3 and 8.
James T. Frame,	Transitman, Sections 4 and 9.
James B. Flaws, Ralph C. McPherson,	Assistant Transitmen on line and grade work.
Daniel S. Bell, *Francis J. Murphy, Hyman Leftovith,	Rodmen on line and grade work.
C. Leonard Brown, Sections 1, 5 and 9, Austin E. Joyce, Sections 2, 3 and 8, *Wesley A. Rowell, Section 3, Roy C. Aiken, Section 4, *Frank J. Eager, Section 4. Arthur E. Lucy, Sections 5 and 8.	Transitmen whose duties have largely been inspecting construction work, under the supervision of the Assistant Engineer on the ground.
Moses L. Browne, Frederick W. Fletcher, Charles J. Rycroft, Peter J. Raftus, *Edwin H. Davis, *Walter L. Scanlan, *Charles J. Mundo,	Rodmen whose duties have largely been inspecting construction work, under the supervision of the Assistant Engineer on the ground.
Thomas H. Keenan,	Messenger.
*Charles C. Johnson, Paul Swartz,	Chemists. Testing cement, pitch and other material, also superintending making of concrete sheeting, etc.
A. W. Parker,	Inspector of steel work.

CLERK, STENOGRAPHERS, ETC.

Arthur B. Carter,	Clerk and stenographer. Correspondence and compilation of data.
Rose A. McMahon,	Stenographer.
*Jeremiah L. Murphy,	Messenger.
W. Frederick Coppinger,	Messenger.
Joseph P. Sheerin,	Messenger and stenographer.
Michael J. Pendergast,	Messenger and stenographer.
Charles E. Fay,	Messenger in draughting room; blue-printing, care of plans.

APPENDIX E.

SOME OF THE CONTRACTORS WHO HAVE DONE WORK FOR THE COMMISSION DURING THE YEAR ENDING JUNE 30, 1906.

NAME.	CONTRACT.
NEW ENGLAND STRUCTURAL CO., Everett, Mass.	Structural steel for Sections 7, 8, 9 and part of 4, Washington-street Tunnel.
PATRICK MCGOVERN, Boston. Principal foremen: Patrick Porter, John Colleran.	Sections 1, 2 and 8, and entrance to station, south side of Lagrange street.
JONES & MEEHAN, Boston. Principal foreman: Michael Tallent.	Part of Section 3, Washington-street Tunnel.
HUGH NAWN CONTRACTING CO., Boston. Principal foremen: A. E. Weaving, James McManus,	Part of Section 3, and Section 4, Washington-street Tunnel.
H. P. CONVERSE & CO., Philadelphia, Pa.	Steel tie-rods, etc., for Section 4, and structural steel for part of Section 10, Washington-street Tunnel.
FRED A. HOUDLETTE & SON, Boston.	Steel for Section 5, Washington-street Tunnel.
COLEMAN BROTHERS, Boston. Engineer: John A. Starr. Principal foremen: John Colleran, Henry Strupney.	Section 5, and sewer to prevent siphon under, Washington-street Tunnel.
JAMES J. COUGHLAN CONSTRUCTION CO., Boston. Principal foremen: Henry Strupney, Thomas McMahon.	Section 9, Washington-street Tunnel.
WOODBURY & LEIGHTON CO., Boston.	Building over Atlantic-avenue Station, Section B, East Boston Tunnel.

Whittier Machine Co., Boston.	Elevators, Atlantic Avenue Station, Section B, East Boston Tunnel.
D. J. Kiley, Boston.	Repaving parts of State street, East Boston Tunnel.
The Cambria Steel Co., Philadelphia, Pa.	Structural steel.
Harrington, Robinson & Co., Boston.	Steel for pipe crossing, Section 4 of the Washington-street Tunnel.
A. C. Harvey Co., Boston.	Structural steel.
Fitz, Dana & Co., Boston.	Structural steel.
Belmont Iron Works, Philadelphia, Pa.	Structural steel.
United Concrete Machinery Co. Boston.	Steel rods.
Chelmsford Foundry Co., Boston.	Metal grilles at Atlantic-avenue Station.

APPENDIX F.

Canvass of Bids for Repaving State Street between Chatham Row and the East Line of Commercial Street and for Raising the Grade and Repaving in State Street around the Station of the East Boston Tunnel at Atlantic Avenue.—Bids Opened Oct. 5, 1905.

Bidders and Addresses.	200 cu. yds. of gravel filling deposited in place.	900 sq. yds. of granite block paving relaid with pitch and pebble joints.	1,100 sq. yds. of granite block paving relaid with gravel joints.	90 sq. yds. of granite crosswalk flagging set with gravel joints.	75 sq. yds. of granite crosswalk flagging reset with pitch and pebble joints.	275 lin. ft. of edge stone reset.	250 sq. yds. of brick sidewalk relaid.	150 cu. yds. of concrete for base.	Totals.	Time of Completion.
	a	b	c	d	e	f	g	h		
James F. Dooley, 9 Cornhill, Boston.	$1.25 250.00	$1.20 1,080.00	$1.00 1,100.00	$.50 45.00	$1.00 75.00	$.25 68.75	$.40 100.00	$6.75 1,012.50	3,731.25	5 weeks.
Coleman Bros., 15 Court Sq., Boston.	.50 100.00	.80 720.00	.70 770.00	.50 45.00	.70 52.50	.30 82.50	.40 100.00	8.00 1,200.00	3,070.00	
J. J. Sullivan, 95 Milk St., Boston.	1.00 200.00	.73 657.00	.65 715.00	.65 58.50	.73 54.75	.25 68.75	.38 95.00	6.25 937.50	2,786.50	Nov. 15, 1905.
John T. Shea, Jr., 696 E. Sixth St., S. Boston.	1.20 240.00	.75 675.00	.50 550.00	.75 67.50	.80 60.00	.20 55.00	.25 62.50	4.75 712.50	2,422.50	30 days.
Robert C. Browne, 631 Dorchester Av., S. Boston.	.80 160.00	.81 729.00	.43 473.00	.60 54.00	.85 63.75	.15 41.25	.28 70.00	5.54 831.00	2,422.00	
Wm. J. Rafferty & Co., 56 Dorchester Av., S. Boston.	.35 70.00	.73 657.00	.45 495.00	.50 45.00	.90 67.50	.13 35.75	.25 62.50	5.26 789.00	2,221.75	Oct. 28. 1905.
D. J. Kiley, 95 Milk St., Boston.	.50 100.00	.75 675.00	.48 528.00	.50 45.00	.75 56.25	.12 33.00	.25 62.50	4.50 675.00	2,174.75	Nov. 5, 1905,

Note.—The contract was awarded to D. J. Kiley.

APPENDIX G.

CANVASS OF BIDS FOR ENTRANCE TO THE WASHINGTON-STREET TUNNEL ON THE SOUTH SIDE OF LAGRANGE STREET.—BIDS OPENED JAN. 9, 1906.

BIDDERS AND ADDRESSES.	1,300 Cu. Yds. Earth Excavation.	500 Cu. Yds. Concrete in Station Walls, etc.	250 Cu. Yds. Concrete other than that in Item (b).	Setting 7 Tons Steel Weighing less than 6 Lbs. per Lin. Ft.	Setting 25 Tons Steel Weighing 6 Lbs. or more per Lin. Ft.	Removing Foundations, Walls, Floors, etc.	2,200 Sq. Yds. Tarred Felt, Pitch, etc , for Waterproofing.	Underpinning, Supporting and Protecting Buildings, and other Work and Risks not Covered by Other Items.	Time of Completion.	Totals.
	a	b	c	e	f	g	i	k	1906	
Hugh Nawn Contracting Co., 82 Savin St., Roxbury.	$5.00 6,500.00	$10.00 5,000.00	$14.00 3,500.00	$12.00 84.00	$15.00 375.00	$1,800.00	$ .20 440.00	$5,000.00	June 1	$22,699.00
Coleman Bros., 15 Court Sq., Boston.	5.00 6,500.00	12.00 6,000.00	15.00 3,750.00	15.00 105.00	20.00 500.00	700.00	.25 550.00	3,000.00	April 1	21,105.00
W. A. & H. A. Root, Winthrop.	2.50 3,250.00	6.50 3,250.00	8.00 2,000.00	35.00 245.00	20.00 500.00	1,975.00	.60 1,320.00	7,890.00	May 1	20,430.00
Falvey & Kelley, 13 Centre Ave., Dorchester.	4.00 5,200.00	12.00 6,000.00	16.00 4,000.00	30.00 210.00	30.00 750.00	500.00	.30 660.00	3,000.00	April 20	20,320.00
Jas. J. Coughlan Const. Co., 19 Worthington St., Roxbury.	5.00 6,500.00	11.00 5,500.00	13.00 3,250.00	11.00 77.00	15.00 375.00	550.00	.45 990.00	1,990.00	....	19,232.00
Metropolitan Contrg. Co. 95 Milk St., Boston.	4.30 5,590.00	9.25 4,625.00	10.35 2,587.50	15.00 105.00	20.00 500.00	400.00	.20 440.00	2,300.00	May 1	16,547.50
Patrick McGovern, 6 Beacon St., Boston.	3.75 4,875.00	9.00 4,500.00	11.00 2,750.00	9.00 63.00	12.00 300.00	450.00	.15 330.00	1,000.00	April 1	14,268.00

NOTE.—The contract was awarded to Patrick McGovern.

APPENDIX H.

CANVASS OF BIDS FOR STEEL AND IRON WORK, SECTIONS 7 AND 8, WASHINGTON-STREET TUNNEL.—BIDS OPENED FEB. 6, 1906.

Time of Delivery Called for by Specifications: 1st Instalment, April 2, 1906; 2d Instalment, May 1, 1906.

BIDDERS AND ADDRESSES.	11,000 Lbs. Steel Tie Rods.		230,000 Lbs. Structural Steel.		11,000 Lbs. Cast Steel.		5,000 Lbs. Cast Iron.		800 Lbs Steel Turn Buckles.		Grand Total.
	Price per Lb.	Total Price.	Price per Lb.	Total Price.	Price per Lb.	Total Price.	Price per Lb.	Total Price.	Price per Lb.	Total Price	
Owego Bridge Co., Owego, N. Y.	$.04	$440.00	*$.0325 .0425	*$7,475.00 9,775.00	$.07	$770.00	$.0425	$212.50	$.10	$80.00	*$8,977.50 11,277.50
W. E. Clark & Co., 120 Milk St., Boston.	.....	....	.0425	per lb. for	entire lot	....	....	....	....	....	10,956.50
H. P. Converse & Co., 120 Milk St., Boston.	.03	330.00	.0365	8,395.00	.07	770.00	.019	95.00	.075	60.00	9,650.00
Eastern Bridge & Structural Co., Station A, Worcester.	.0325	357.50	.034	7,820.00	.075	825.00	.035	175.00	.10	80.00	9,257.50
New Jersey Bridge Co., Fuller Bldg., New York.	.....	....	.0335	per lb. for	entire lot	....	....	....	.....	....	8,636.30
Fred A. Houdlette & Son, 93 Broad St., Boston.	.033	363.00	.032	7,360.00	.032	352.00	.0175	87.50	.033	26.40	8,188.90
L. F. Shoemaker & Co., 712 Harrison Bldg., Philadelphia.	.0325	357.50	.0315	7,245.00	.0325	357.50	.0225	112.50	.10	80.00	8,152.50
Belmont Iron Works, Washington Ave., Philadelphia.	.0375	412.50	.0298	6,854.00	.0575	632.50	.035	175.00	.08	64.00	8,138.00
American Bridge Co., 89 State St., Boston.	.0323	355.30	.0308	7,084.00	.034	374.00	.0325	162.50	.14	112.00	8,087.80
Berlin Construction Co., 131 State St., Boston.	.036	396.00	.029	6,670.00	.0625	687.50	.021	105.00	.078	62.40	7,920.90
N. E. Structural Co., 110 State St., Boston.	.035	385.00	.0285	6,555.00	.06	660.00	.02	100.00	.08	64.00	7,764.00

NOTE.—The contract was awarded to N. E. Structural Co.

*If time for delivery is extended.

APPENDIX I.

CANVASS OF BIDS FOR STEEL AND IRON WORK, SECTION 9, WASHINGTON-STREET TUNNEL. — BIDS OPENED MARCH 6, 1906.

Time of Delivery called for by Specifications: 1st Instalment, May 1, 1906 ; 2d Instalment, May 29, 1906 ; 3d Instalment, June 26, 1906.

BIDDERS AND ADDRESSES.	900,000 Lbs. Structural Steel.		45,000 Lbs. Cast Steel.		Grand Total.	Time of Delivery.		
	Price Per Lb.	Total Price.	Price per Lb.	Total Price.		1st Instalment.	2d Instalment.	3d Instalment.
Eastern Bridge & Struct. Co., Sta. A, Worcester, Mass.	$.0339	$30,510.00	$.065	$2,925.00	$33,435.00	As required by Specifications.	As required by Specifications.	As required by Specifications.
Belmont Iron Works, Washington Ave., Phila.	.0333	29,770.00	.06	2,700.00	32,670.00	do.	do.	do.
L. F. Shoemaker & Co., 712 Harrison Bldg., Phila.	.0324	29,160.00	.0324	1,458.00	30,618.00	do.	do.	do.
W. E. Clark & Co., 120 Milk St., Boston.	.0323	29,070.00	.0323	1,453.50	30,523.50	do.	do.	do.
Berlin Construction Co., 131 State St., Boston.	.0315	28,350.00	.04	1,800.00	30,150.00	do.	do.	do.
American Bridge Co., 89 State St., Boston.	.0308	27,720.00	.048	2,160.00	29,880.00	July 10, 1906,	balance August	1, 1906.
N. E. Structural Co , 110 State St., Boston.	.03	27,000.00	.035	1,575.00	28,575.00	As required by Specifications.	As required by Specifications.	As required by Specifications.
Boston Bridge Works, 47 Winter St., Boston.	.0283	25,470.00	.0585	2,632.50	28,102.50	June 1, 1906.	June 30, 1906.	July 10, 1906.

NOTE.—The contract was awarded to N. E. Structural Co.

APPENDIX J.

Canvass of Bids for Washington Street–Tunnel—Station 42 + 80 to Station 50 + 60; Section 8. Bids Opened March 6, 1906.

Bidders and Addresses.	25,000 Cu. Yds of Earth Excavation.	Removing and Disposing of 400 Cu. Yds. of Masonry Consisting of Cellar Floors, etc., except that in Item (bb).	Removing and Disposing of 450 Cu. Yds. of Concrete Masonry and Footing Stones from the Existing Subway.	Furnishing, Hauling and putting in place 9,000 Cu. Yds. of Concrete for all Purposes except that in Item (cc).	Furnishing, Hauling and putting In Place around Steel Beams 200 Cu Yds. of Concrete.	Furnishing and Laying 200 Cu. Yds. of Brick Masonry.	Laying 125 Lin. Ft. of 20 In. Vitrified Pipe for Sewer.	Laying 175 Lin. Ft. of 10 In. and 12 In. Vitrified Pipe for Sewer.	Laying 100 Lin. Ft. of 6 In. and 8 In. Vitrified Pipe for Sewer.	Laying 20 Lin. Ft. of 3 In. or 4 In. Vitrified Pipe.	Setting in Place and Securing 300 Tons of Steel and Iron Weighing Less than 6 Lbs. per Lin. Ft.	Setting in Place and Securing 125 Tons of Steel and Iron Weighing 6 Lbs. or more per Lin. Ft	Furnishing, Preparing and Applying 5,000 Sq. Yds. of Portland Cement Mortar.	Preparing and Applying 5,000 Sq. Yds. of Waterproof Coating of Pitch or Asphalt.	Preparing and Applying 20,000 Sq. Yds. of Tarred Felt, Pitch, etc.	Underpinning, Supporting and Protecting Buildings, etc., and all other Work and Risks not covered by other Items.	Totals.
	a	b	bb	c	cc	d	e	ee	3e	4e	f	ff	g	h	i	k	
Bruno, Salomone & Petitti, 23 Court St., Boston.	$14.00 350,000.00	$30.00 12,000.00	$50.00 22,500.00	$15.00 135,000.00	$30.00 6,000.00	$30.00 6,000.00	$3.00 375.00	$2.00 350.00	$2.00 200.00	$2.00 40.00	$30.00 9,000.00	$30.00 3,750.00	$1.00 5,000.00	$.75 3,750.00	$.50 10,000.00	$150,000.00	$713,965.00
Cranford Co., 52 Ninth St., Brooklyn, N. Y.	6.40 160,000.00	4.00 1,600.00	25.00 11,250.00	10.75 96,750.00	15.00 3,000.00	20.00 4,000.00	1.00 125.00	.60 105.00	.50 50.00	.30 6.00	16.00 4,800.00	15.00 1,875.00	.50 2,500.00	.50 2,500.00	.27 5,400.00	134,100.00	428,061.00
W. H. Keyes & Co., 95 Milk St., Boston.	6.00 150,000.00	7.50 3,000.00	14.00 6,300.00	13.20 118,800.00	16.00 3,200.00	20.00 4,000.00	1.50 187.50	1.00 175.00	1.00 100.00	1.00 20.00	20.00 6,000.00	20.00 2,500.00	.60 3,000.00	.50 2,500.00	.25 5,000.00	85,000.00	389,782.50
Fred S. & A. D. Gore Corporation, 511–512 Old South Bldg., Boston.	6.08 152,000.00	5.00 2,000.00	15.00 6,750.00	12.90 116,100.00	14.50 2,900.00	15.00 3,000.00	1.00 125.00	.50 87.50	.30 30.00	.20 4.00	15.00 4,500.00	10.00 1,250.00	.50 2,500.00	.30 1,500.00	.25 5,000.00	89,179.00	386,925.50
Metropolitan Contracting Co 95 Milk St., Boston.	6.10 152,500.00	6.00 2,400.00	15.00 6,750.00	12.25 110,250.00	14.80 2,960.00	20.00 4,000.00	.50 62.50	.50 87.50	.50 50.00	.50 10.00	16.00 4,800.00	18.00 2,250.00	.40 2,000.00	.35 1,750.00	.25 5,000.00	48,300.00	343,170.00
Hugh Nawn Contracting Co., 82 Savin St., Roxbury.	6.00 150,000.00	6.00 2,400.00	10.00 4,500.00	12.00 108,000.00	15.00 3,000.00	18.00 3,600.00	2.00 250.00	2.00 350.00	1.00 100.00	1.00 20.00	12.00 3,600.00	15.00 1,875.00	.50 2,500.00	.30 1,500.00	.30 6,000.00	52,500.00	340,195.00
Charles R. Gow Co., 79 Milk St., Boston.	5.50 137,500.00	5.00 2,000.00	15.00 6,750.00	12.00 108,000.00	15.00 3,000.00	18.00 3,600.00	2.00 250.00	1.00 175.00	.50 50.00	.25 5.00	15.00 4,500.00	15.00 1,875.00	.40 2,000.00	.50 2,500.00	.20 4,000.00	45,000.00	321,205.00
Coleman Bros., 15 Court Sq., Boston.	4.50 112,500.00	6.00 2,400.00	20.00 9,000.00	12.00 108,000.00	15.00 3,000.00	20.00 4,000.00	1.50 187.50	.60 105.00	.50 50.00	.25 5.00	15.00 4,500.00	20.00 2,500.00	.50 2,500.00	.40 2,000.00	.20 4,000.00	63,000.00	317,747.50
Seely-Taylor Co., 913 Tremont Bldg., Boston.	5 00 125,000.00	5.00 2,000.00	10.00 4,500.00	12.00 108,000.00	15.00 3,000.00	20.00 4,000.00	4.00 500.00	2.00 350.00	1.50 150.00	1.00 20.00	15.00 4,500.00	20.00 2,500.00	.50 2,500.00	.40 2,000.00	.25 5,000.00	50,000.00	314,020.00
Patrick McGovern, 6 Beacon St., Boston.	5.65 141,250 00	5.00 2,000.00	10.00 4,500.00	11.00 99,000.00	15.00 3,000.00	15.00 3,000.00	1.50 187.50	1.00 175.00	.75 75.00	.25 5.00	13.50 4,050.00	15.00 1,875.00	.50 2,500.00	.30 1,500.00	.25 5,000.00	42,150.00	310,267.50
James J. Coughlan Const. Co., 19 Worthington St., Roxbury	5 00 125,000.00	7.00 2,800.00	10.00 4,500.00	11.50 103,500.00	13.50 2,700.00	17.00 3,400.00	1.25 156.25	1.25 218.75	1.00 100.00	.80 16.00	18.00 5,400.00	18.00 2,250.00	.40 2,000.00	.40 2,000.00	.18 3,600.00	40,000.00	297,641.00

Note.—The contract was awarded to Patrick McGovern.

APPENDIX K.

CANVASS OF BIDS FOR SEWER TO PREVENT SIPHON UNDER WASHINGTON-STREET TUNNEL AT HANOVER STREET.—BIDS OPENED MARCH 29, 1906.

BIDDERS AND ADDRESSES.	380 Lin. Ft. Open Cut Excavation for 4 Ft 6 In. Sewer.	620 Lin. Ft. Open Cut Excavation between Sta. 3 + 80 and Sta. 10 + 00 for 3 Ft. 6 In. Sewer.	515 Lin. Ft. Open Cut Excavation between Sta's. 10 + 00 and 15 + 15 for 3 Ft. 6 In. Sewer.	515 Lin. Ft. Tunnel Excavation between Sta's. 10 + 00 and 15 + 15 for 3 Ft. 6 In. Sewer.	100 Cu. Yds. of Excavation for Relocation of Structures.	100 Cu. Yds. of Excavation for Sewer in Trench Below Grade.	350 Cu. Yds. Brick Masonry in Place in Trench.	150 Cu. Yds. Brick Masonry in Place in Tunnel.	300 Cu. Yds. Concrete in Place in Trench.	70 Cu. Yds. Concrete in Place in Tunnel.	For all Work Southerly from Sta. 15 + 15.	25,000 Ft. B. M. Lumber for Sheeting and Shoring Left in Place in Open Trench.	25,000 Ft. B. M. Lumber for Permanent Use in Open Trench Other than for Sheeting and Shoring.	6,000 Lin. Ft. Spruce Piles Furnished and in Place	For Laying 400 Lin. Ft. 6 In. and 8 In. Pipe for Underdrain Furnished by Commission.	For Laying 400 Lin. Ft 10 In and 15 In. Pipe for Underdrain Furnished by Commission.	100 Pipe Branches	100 Cu. Yds. Gravel or Sand for Filling below Grade.	TOTALS		TIME OF COMPLETION
	a	b	c	cc	d	e	f	ff	g	gg	h	i	j	k	l	ll	m	n	By Open Cut.	If 515 Ft. Should be done by Tunnel.	
Peter W. Hill, 426 Old South Bldg., Boston.	$40.00 15,200.00	$20.00 12,400.00	$15.00 7,725.00	$12.00 6,180.00	$3.00 300 00	$3.00 300.00	$20.00 10,000.00	$22.00 3,300.00	$12.00 4,440.00	$15.00 1,050.00	4,000.00	$30.00 750.00	$50.00 1,250.00	$.50 3,000.00	$ .50 200.00	$2.00 800.00	$1.00 100.00	$2.00 200.00	$60,665.00	$59,630.00	July 30, 1906.
F. S. & A. D. Gore Corp., 511–512 Old South Bldg., Boston.	22.50 8,550.00	18.50 11,470.00	21.50 11,072.50	19.50 10,042.50	2.50 250.00	2.50 250.00	16.00 8,000.00	18.00 2,700.00	11.00 4,070.00	12.50 875.00	5,630.00	30.00 750.00	45.00 1,125.00	.25 1,500.00	.30 120.00	.40 160.00	.50 50.00	2.00 200.00	53,197.50	52,572.50	In 70 days
George W. Regan, Dorchester, Mass.	21.50 8,170.00	17.00 10,540.00	19.00 9,785.00	17.00 8,755.00	6.00 600.00	6.00 600.00	17.00 8,500.00	25.00 3,750.00	11.75 4,347.50	16.00 1,120.00	2,950.00	30.00 750.00	40.00 1,000.00	.30 1,800.00	.20 80.00	.50 200.00	1.00 100.00	1.00 100.00	49,522.50	49,990.00	Oct. 1, 1906.
James J. Coughlan Cons. Co., 19 Worthington St., Roxbury.	20.00 7,600.00	17.00 10,540.00	16.00 8,240.00	16.00 8,240.00	3.50 350.00	3.50 350.00	18.00 9,000.00	19.00 2,850.00	12.00 4,440.00	13.00 910.00	4,500.00	25.00 625.00	42.00 1,050.00	.25 1,500.00	.15 60.00	.15 60.00	1.00 100.00	1.50 150.00	48,565.00	48,785.00	June 20, 1906
Falvey & Kelly, Dorchester, Mass.	20.00 7,600.00	15.00 9,300.00	25.00 12,875.00	15.00 7,725.00	3.00 300.00	3.50 350.00	19.00 9,500.00	20.00 3,000.00	11.00 4,070.00	12.00 840.00	4,000.00	30.00 750.00	40.00 1,000.00	.40 2,400.00	.50 200.00	.75 300.00	1.00 100.00	2.00 200.00	52,945.00	48,015.00	July 1, 1906.
John E. Palmer, 166 Devonshire St., Boston.	25.00 9,500.00	16.00 9,920.00	23.00 11,845.00	12.50 6,437.50	4.00 400.00	4.00 400.00	17.00 8,500.00	19.00 2,850.00	11.00 4,070.00	12.00 840.00	3,500.00	25.00 625.00	40.00 1,000.00	.30 1,800.00	1.00 400.00	1.25 500.00	1.00 100.00	1.70 170.00	52,730.00	47,692.50	Aug. 10, 1906.
Patrick McGovern, 6 Beacon St., Boston.	20.00 7,600.00	16.00 9,920.00	17.00 8,755.00	17.00 8,755.00	5.00 500.00	5.00 500.00	16.00 8,000.00	20.00 3,000.00	12.00 4,440.00	15.00 1,050.00	3,000.00	32.00 800.00	35.00 875.00	.25 1,500.00	.20 80.00	.50 200.00	1.00 100.00	1.50 150.00	46,420.00	47,230.00	Oct. 1, 1906.
Charles R. Gow Co., 79 Milk St., Boston.	20.00 7,600.00	15.00 9,300.00	20.00 10,300.00	15.00 7,725.00	3.00 300.00	3.00 300.00	18.00 9,000.00	20.00 3,000.00	10.00 3,700.00	12.00 840.00	3,500.00	35.00 875.00	45.00 1,125.00	.25 1,500.00	.20 30.00	.40 160.00	1.00 100.00	2.00 200.00	48,040.00	45,905.00	Sept. 1, 1906.
Bruno, Salomone & Petitti, 23 Court St., Boston.	13.50 5,130.00	11.75 7,285.00	18.00 9,270.00	25.00 12,875.00	1.75 175.00	2.50 250.00	16.00 8,000.00	21.00 3,150.00	9.50 3,515.00	12.50 875.00	3,000.00	20.00 500.00	45.00 1,125.00	.30 1,800.00	.50 200.00	.60 240.00	1.50 150.00	1.50 150.00	40,790.00	45,355.00	Aug. 1, 1906.
George W. Philips, Dorchester, Mass.	17.80 6,764.00	17.80 11,036.00	17.80 9,167.00	20.00 10,300.00	1.50 150.00	2.50 250.00	15.00 7,500.00	17.00 2,550.00	8.00 2,960.00	10.00 700.00	2,000.00	30.00 750.00	38.00 950.00	.25 1,500.00	.25 100.00	.50 200.00	.20 20.00	1.50 150.00	43,497.00	45,070.00	Aug. 1, 1906.
Hugh Nawn Contrg. Co., 82 Savin St., Roxbury.	15.00 5,700.00	10.50 6,510.00	18.75 9,656.25	18.00 9,270.00	3.00 300.00	3.00 300.00	15.00 7,500.00	20.00 3,000.00	8.00 2,960.00	10.00 700.00	4,000.00	25.00 625.00	40.00 1,000.00	.30 1,800.00	.30 120.00	.75 300.00	.25 25.00	1.50 150.00	40,946.25	41,450.00	Oct. 1, 1906.
Rowe & Perrini, South Framingham, Mass.	13.00 4,940.00	13.00 8,060.00	20.00 10,300.00	20.00 10,300.00	2.00 200.00	2.50 250.00	14.00 7,000.00	18.00 2,700.00	8.50 3,145.00	10.00 700.00	2,500.00	25.00 625.00	35.00 875.00	.40 2,400.00	.10 40.00	.20 80.00	.25 25.00	2.00 200.00	40,640.00	41,345.00	Sept. 1, 1906.
Coleman Bros., 15 Court Sq., Boston.	16.00 6,080.00	11.00 6,820.00	13.00 6,695.00	13.00 6,695.00	3.00 300.00	4.00 400.00	15.00 7,500.00	18.00 2,700 00	10.00 3,700.00	12.00 840.00	3,500.00	25.00 625.00	45.00 1,125.00	.20 1.200.00	.50 200.00	1.00 400 00	1.50 150.00	1.50 150.00	38,845.00	39,435.00	June 15, 1906.

NOTE.—The contract was awarded to Coleman Bros.

APPENDIX L.

CANVASS OF BIDS FOR ADDITIONAL STEEL AND IRON WORK, SECTION 9, WASHINGTON-STREET TUNNEL.—BIDS OPENED MAY 1, 1906.

BIDDERS AND ADDRESSES.	Item (a). 80,000 Lbs. Structural Steel, Cast Steel and Cast Iron.		Alternative Bid. Item (b). The Commission Furnishing and Delivering all the I-beams (about 52,000 Lbs.) to the Yard of the Contractor and the Contractor Furnishing all other Material and doing all the Work. Total Weight 80,000 Lbs.				Time of Delivery, 1906.	
	Price Per Lb.	Total Price.	Price Per Lb.	Price to be Paid to the Contractor.	Cost Except Teaming of 52,000 Lbs. Furnished by Commission.	Total Cost to Commission Except Teaming.	Item (a).	Item (b).
L. F. Shoemaker & Co., 712 Harrison Bldg., Phila.	$.0333	$2,664.00	$.0225	$1,800.00	$1,040.00	$2,840.00	Sept. 10.	Aug. 1.
Boston Bridge Works, 47 Winter St., Boston.	.0315	2,520.00	.0220	1,760.00	1,040.00	2,800.00	July 14.	July 14.
Eastern Bridge & Structural Co., Sta. A, Worcester.	.0310	2,480.00	....	....	....	....	Aug. 1.	....
Belmont Iron Works, Washington Ave., Phila.	.0305	2,440.00	....	....	....	....	July 15.	....
N. E. Structural Co., 110 State St., Boston.	.0298	2,384.00	.0195	1,560.00	1,040.00	2,600.00	July 14.	July 14.
H. P. Converse & Co., 120 Milk St., Boston.	.0275	*2,200.00	.0198	1,584.00	1,040.00	2,624.00	July 14.	July 14.

*Contract awarded.

APPENDIX M.

CANVASS OF BIDS FOR ADDITIONAL STEEL AND IRON WORK, PART OF SUMMER-STREET STATION, SECTION 4, WASHINGTON-STREET TUNNEL.—BIDS OPENED MAY 7, 1906.

BIDDERS AND ADDRESSES.	Item (a). Altering 9 Cols. Furnished by the Commission (Cols. 1-9) and Making 7 Sets of Footings (L 1-7) and Furnishing the New Material attached to them.	Item (b) Material Shown on Plan No. 7641 and for Girders 1-10 complete with Battens, Knees and Plates (about 20,000 Lbs.).		AMOUNTS.
		Price per Lb.	Total Price.	
F. A. Houdlette & Son, 93 Broad St., Boston.	$416.00	$0.41	$820.00	$1,236.00
Boston Bridge Works, 47 Winter St., Boston.	140.00	.03	600.00	740.00
N. E. Structural Co., 110 State St., Boston.	125.00	.0275	550.00	675.00

NOTE.—The contract was awarded to N. E. Structural Co.

APPENDIX N.

CANVASS OF BIDS FOR WASHINGTON-STREET TUNNEL.—STATION 50 + 60 TO STATION 55 + 05.5; SECTION 9. BIDS OPENED MAY 8, 1906.

BIDDERS AND ADDRESSES.	20,000 Cu. Yds. Earth Excavation	Removing and Disposing of 400 Cu. Yds. Masonry Cellar Floors, etc	Removing and Disposing of 10 Cu. Yds. Concrete Masonry from Existing Subway	Furnishing and Placing 5,000 Cu. Yds. Concrete Masonry, except that included in Item (cc).	Furnishing and Placing 700 Cu. Yds. Concrete Masonry around Steel Beams, etc.	Furnishing and Laying 200 Cu. Yds. Brick Masonry.	Excavating for and Laying 300 Lin. Ft. 24 In. and 18 In. Vitrified Pipe for Sewer, including Back-filling, Repaving and Disposing of Surplus Earth	Laying 100 Lin. Ft. 10 In. and 12 In. Vitrified Pipe.	Laying 200 Lin. Ft. 6 In. and 8 In. Vitrified Pipe	Laying 800 Lin. Ft. 3 In. and 4 In. Vitrified Pipe.	Setting in Place and Securing 150 Tons of Steel and Iron Weighing Less than 6 Lbs. Per Lin. Ft.	Setting in Place and Securing 500 Tons of Steel and Iron Weighing 6 Lbs. or More Per Lin. Ft.	Furnishing, Preparing and Applying 3,000 Sq. Yds. of Portland Cement Mortar for Coating.	Preparing and Applying 2,000 Sq. Yds. of Waterproof Coating of Pitch or Asphalt.	Preparing and Applying 20,000 Sq. Yds. Tarred Felt, Pitch, etc	Underpinning, Supporting and Protecting Buildings, etc., and for all other Work and Risks not Covered by other Items of this Contract	Totals
	a	b	bb	c	cc	d	e	ee	3e	4e	f	ff	g	h	i	k	
Degnon Contracting Co., 218 E. 42nd St., New York.	$5.90 118,000.00	$7.00 2,800.00	$25.00 250.00	$14.00 70,000 00	$20 00 14,000.00	$20.00 4,000.00	$8.00 2,400.00	$1.00 100.00	$0.80 160.00	$0.50 400.00	$20.00 3,000.00	$20.00 10,000.00	$0.70 2,100.00	$0.30 600.00	$0.25 5,000.00	$45,000.00	$277,810.00
Seely-Taylor Co., 913 Tremont Bldg., Boston.	6.00 120,000.00	5.00 2,000.00	20 00 200.00	12.00 60,000.00	15.00 10,500.00	20 00 4,000.00	10.00 3,000.00	2.00 200.00	1.50 300.00	1.00 800.00	15.00 2,250 00	20.00 10,000.00	.50 1,500.00	.40 800.00	.25 5,000.00	50,000.00	270,550.00
Bruno, Salomone & Petitti, 23 Court St., Boston.	6.50 130,000.00	10.00 4,000.00	20.00 200.00	12.50 62,500.00	14.00 9,800.00	18.00 3,600 00	8.00 2,400.00	1.00 100.00	.75 150.00	.50 400.00	20.00 3,000 00	20.00 10,000.00	50 1,500 00	.50 1,000.00	.25 5,000.00	35,000.00	268,650.00
W. H. Keyes & Co., 95 Milk St., Boston.	6 10 122,000 00	6.00 2,400.00	20.00 200.00	13.40 67.000.00	16.00 11,200.00	20.00 4,000.00	2.00 600.00	1.50 150.00	1.00 200.00	1.00 800 00	18 00 2,700 00	20 00 10,000.00	.60 1,800.00	.50 1,000.00	.30 6,000.00	35,000.00	265,050.00
Jones & Meehan, Jamaica Plain	5.50 110,000.00	6.00 2.400.00	20.00 200.00	11.00 55,000.00	14 00 9,800.00	20.00 4,000 00	15.50 4,650.00	1.00 100.00	.75 150.00	.50 400.00	12.00 1,800.00	16.00 8,000.00	.50 1,500.00	.50 1,000.00	.20 4,000.00	55,000.00	258,000.00
Cranford Co., 52 9th St., Brooklyn, N. Y.	6.20 124,000 00	4.00 1,600.00	25.00 250.00	11.00 55,000.00	15.00 10,500.00	15.00 3,000.00	5.00 1,500.00	.75 75.00	.50 100 00	.30 240 00	16 00 2,400 00	15.00 7,500 00	.50 1,500.00	.40 800.00	.27 5,400.00	40,000.00	253,865.00
Fred S. & A. D. Gore Corp., 511–12 Old South Bldg., Boston.	6.00 120,000.00	5.00 2,000.00	15.00 150.00	12.00 60,000.00	15.00 10,500.00	15.00 3,000.00	3.80 1,140.00	1 00 100.00	.50 100 00	.25 200.00	15.00 2,250 00	15 00 7,500 00	.50 1,500 00	.30 600.00	.25 5,000.00	39,000.00	253,040.00
Metropolitan Contrg. Co., 95 Milk St., Boston.	5.75 115,000 00	6.00 2,400.00	15 00 150.00	12.50 62,500.00	14 75 10,325.00	20.00 4,000.00	6.50 1,950 00	50 50 00	.50 100 00	25 200.00	16.00 2,400.00	18.00 9,000.00	.40 1,200.00	.35 700 00	.25 5,000.00	35,000 00	249,975.00
Hugh Nawn Contrg. Co., 82 Savin St., Roxbury.	5.00 100,000 00	10.00 4.000.00	20.00 200.00	12.00 60,000.00	15.00 10,500.00	15.00 3,000.00	8.00 2,400 00	1.00 100 00	1.00 200.00	1 00 800 00	12.00 1,800.00	15.00 7,500.00	.60 1,800 00	.30 600.00	.30 6,000.00	39,000.00	237,900.00
Coleman Bros., 15 Court Sq., Boston.	4.85 97,000.00	6.00 2,400.00	25.00 250 00	11.00 55,000.00	15.00 10,500 00	20.00 4,000.00	11.00 3,300.00	60 60 00	.50 100.00	.25 200 00	15.00 2,250.00	20.00 10,000.00	.50 1,500.00	.40 800.00	.20 4,000.00	45,000 00	236,360.00
P. McGovern, 6 Beacon St., Boston.	5.50 110,000.00	5.00 2,000.00	20 00 200 00	11.00 55,000 00	16.00 11,200.00	20.00 4,000.00	10.00 3,000.00	1.00 100.00	.50 100.00	.25 200.00	15.00 2,250.00	18.00 9,000 00	.50 1,500 00	.30 600.00	.25 5,000.00	32,000.00	236,150.00
Chas. R. Gow Co., 79 Milk St., Boston.	5.25 105,000 00	5.00 2,000.00	20.00 200.00	12 50 62,500 00	14.00 9,800.00	18.00 3.600.00	5.00 1,500.00	1.00 100.00	.75 150.00	.25 200 00	12.00 1,800.00	15 00 7,500 00	.30 900.00	.35 700.00	.15 3,000.00	36,000.00	234,950.00
Jas. J. Coughlan Const. Co., 19 Worthington St., Roxbury.	4 25 85,000 00	7.00 2,800.00	10.00 100.00	10 75 53,750.00	13 50 9,450.00	17.00 3,400.00	3.00 900.00	.75 75.00	.60 120.00	.60 480.00	16.00 2,400 00	18 00 9,000.00	.40 1,200.00	.30 600.00	.20 4,000.00	25,000.00	198,275.00

NOTE.—Contract awarded to Jas. J. Coughlan Construction Co.

APPENDIX O.

CANVASS OF BIDS FOR STEEL AND IRON WORK, PART OF SECTION 10, WASHINGTON–STREET TUNNEL.—BIDS OPENED JUNE 5, 1906.

BIDDERS AND ADDRESSES.	For Furnishing 3,600 Lbs. Steel Tie-rods.		For Furnishing 342,500 Lbs. Structural Steel.		Grand Total.	Time of Delivery, 1906.
	Price Per Lb.	Total Price.	Price Per Lb.	Total Price.		
American Bridge Co., 89 State St., Boston.......	$.0362	$130.32	$.041	$14,042.50	$14,172.82	Oct. 4.
Canton Bridge Co., 147 Milk St., Boston.........	.035	126.00	.035	11,987.50	12,113.50	Aug. 4.
N. E. Structural Co., 110 State St., Boston.......	.0324	116.64	.0324	11,097.00	11,213.64	Aug. 4.

NOTE.—Contract awarded to N. E. Structural Co.

THIRTEENTH ANNUAL REPORT

OF THE

BOSTON TRANSIT COMMISSION,

FOR THE YEAR ENDING

JUNE 30, 1907.

BOSTON:
E. W. DOYLE, PRINTER
185 Franklin Street
1907.

BOSTON TRANSIT COMMISSION.

15 Beacon Street, Boston, June 30, 1907.

To the City Council of the City of Boston:

In compliance with Statutes of 1894, chapter 548, section 24, the report of the Boston Transit Commission for the year ending June 30, 1907, is respectfully submitted.

Washington Street Tunnel.

With the exception of Section 6, so-called, near the Old State House, the main structure of the Washington street tunnel is completed from the incline opposite Ash street to a point near the Relief station in Haymarket square. The contract for Section 6, which involves supporting the East Boston tunnel and the construction of the station under the Old State House, should be completed by November 15 next.

The entrances and exits at LaGrange street, Washington and Essex streets, and Franklin street are completed so far as concerns the construction contracts.

The following entrances and exits are under contract:

At the corner of Washington and Boylston streets.
In Temple place.
At the corner of Hayward place and Washington street.
Old South Meeting House.

There remain to be contracted for the entrances and exits at Washington and Winter streets, Washington and Summer streets, and Water and Devonshire streets.

Plans for the north end of the tunnel from Haymarket square under the Boston City Hospital Relief Station have not yet been adopted. The Commission awaits the decision of the Boston Elevated Railway Co. as to the arrangement and location of the elevated and surface tracks which are to connect with the tracks in the tunnel and subway.

Property taken and Settlements for the Same.

September 11, 1906, easements were taken below the surface in small portions of the estates of Robert H. Gardiner, 1-6 Haymarket square, and Augustus L. Thorndike, 97-103 Union street.

January 1, 1907, an easement was taken in the property 14-20 Franklin street belonging to George A. Goddard et al., for an entrance to and exit from the platform for northbound cars extending from Summer street to Franklin street.

February 26, an easement for an exit and entrance was taken in the property of the Old South Association in Boston adjoining the old South Meeting House on its north side.

May 1, a taking was made of an easement in the westerly portion of the Blake estate on Temple place for an entrance to and exit from the south end of the platform for southbound cars, which extends from Winter street to Temple place.

The taking on Hayward place, made in 1905, and that on Franklin street named above, have been settled for. Damages for the taking in Temple place are agreed upon but payment therefor is not to be made until certain conditions are complied with.

An award has been made in the matter of the taking from the Old South Association in Boston and the amount thereof was tendered under Chapter 317, Acts of 1904, and accepted by the Association pro tanto. The Association is left free to seek further damages in the courts but interest on the amount already paid has ceased.

The damages for the taking of the property of A. Shuman at the corner of Boylston and Washington streets have been agreed upon, the settlement being made in part through the re-conveyance of the property to the former owner subject to the easements required for entrance to and exit from the tunnel.

Old State House.

The field office of the Commission which has been located in the westerly portion of the Old State House since the middle of 1903 has been moved to Devonshire street, in compliance with certain provisions of Chapter 385, Acts of 1907.

Repaving Washington Street.

The Commission has paid to the Street Department $18,000 as its share of the expense of repaving Washington street between Beach street and Milk street, and has voted to pay $4,500 toward the cost of repaving from Milk street north.

East Boston Tunnel.

A bronze tablet has been placed on the southerly wall of the Devonshire street station with the following inscription:

EAST BOSTON TUNNEL

ORDERED BY THE LEGISLATURE, 1897

ROGER WOLCOTT, GOVERNOR

JOSIAH QUINCY, MAYOR OF BOSTON

BEGUN AT MAVERICK SQUARE, MAY 5, 1900

OPENED DECEMBER 30, 1904

BUILT BY THE BOSTON TRANSIT COMMISSION

GEORGE G. CROCKER, CHAIRMAN

CHARLES H. DALTON GEORGE F. SWAIN

THOMAS J. GARGAN HORACE G. ALLEN

HOWARD ADAMS CARSON, CHIEF ENGINEER.

Long Wharf Taking.

In the suit of the Proprietors of Long Wharf for damages caused by the taking of an easement under the wharf and for injury to the property resulting from the construction of the East Boston tunnel, the jury awarded the sum of $92,090.79, which has been paid.

Passenger Traffic.

In the Twelfth Annual Report the passenger traffic in the East Boston tunnel was given up to January 31, 1906, with the cost of collection of tolls for the same. Below are given similar figures to the date of this report.

Feb. 1, 1906 to Apr. 30, 1906:		
Receipts	$28,333.47	
Cost	3,909.14	
Net		$24,424.33
May 1, 1906 to July 31, 1906:		
Receipts	$28,831.45	
Cost	4,271.13	
Net		24,560.32
Aug. 1, 1906 to Oct. 31, 1906:		
Receipts	$28,882.26	
Cost	4,307.11	
Net		24,575.15
Nov. 1, 1906 to Jan. 31, 1907:		
Receipts	$31,988.10	
Cost	4,643.28	
Net		27,344.82
Feb. 1, 1907 to Apr. 30, 1907:		
Receipts	$31,502.70	
Cost	4,614.10	
Net		26,888.60
May 1, 1907 to June 30, 1907:		
Receipts	$21,492.59	
Cost	2,991.28	
Net		18,501.31
Total, 1 year and 5 months		$146,294.53

Cost includes wages, cost of exit tickets, cost of entrance tickets, power for lighting and heating, cost of necessary accounting, proportion of indemnity insurance premiums on bonds of collectors, toll collectors and ticket sellers.

CHARLESTOWN BRIDGE.

The vacant land in Charlestown, bounded by Water street, Chamber street and the bridge was sold at auction by the Commission on May 23, 1905. The purchaser paid $500 down at the time of the sale and was to complete his purchase in thirty days, the purchase price being $20,499. His option, however, has been extended from time to time upon the payment of $100 a month, the equivalent of about six per cent. on the purchase price until April 22, 1907, when full payment for the property was made. This transaction closes the connection of the Commission with the Charlestown Bridge.

Subway.

Payment of Rental under the Toll System.

In accordance with that clause of the lease of the subway which provides that if in any one quarter the amount which the company would pay for rental, reckoned on a stated toll for each car, should exceed the amount reckoned on the basis of four and seven-eighths per cent. of the cost, the company shall pay such excess, the following was received :

Auditor's Office.
101 Milk St.

Boston, Mass. Oct. 19th, 1906.

Rent of Subway.

Mr. B. Leighton Beal, *Secy., Boston Transit Commission,* 20 *Beacon St., City.*

Dear Sir:—I wish to report that this company has drawn a voucher in favor of the City of Boston for $5,691.85, being additional rent due for use of the Tremont St. subway for the year ending with Sept. 30th, 1906.

Of this sum $2,187.06 was for the quarter ending with June 30th and $3,504.79 was for the quarter ending with Sept. 30th, this sum being due as provided for in the contract dated Dec. 7th, 1896, for use of the subway, and based on 5c. per trip in place of 4⅞% on the cost.

For the two previous quarters the number of trips were not numerous enough to call for any additional payment.

Very truly yours,
(Signed) H. L. Wilson.
Auditor.

The payments previously made amounted to $14,269.94, making a total of $19,961.79 thus far paid on account of the operation of the toll clause.

Cambridge Connection.

In the Act of 1897, Chapter 500, Section 5, in connection with the construction of an elevated railway in Cambridge, it was provided that the continuation in Boston should be by means of a subway under or near Cambridge street to Scollay square. The Legislature of 1906 permitted the construction of a subway in Cambridge by the Boston Elevated Railway Co. and gave the Commission the alternative of a choice of making the subway terminal in Boston either at Scollay square or Park street. At a conference with the officials of the Boston Elevated Railway Co. they expressed a preference for a line to Park street, and at a public hearing given on December 18, 1906, at which nearly all those present were from Cambridge, a majority of the speakers expressed a similar preference. February 14, 1907, the Commission decided upon that route. Borings, surveys and studies are being made.

EAST AND WEST TUNNEL AND SUBWAY.

The Legislature of the present year passed an act (St. 1907, C. 573) authorizing the construction in Boston of an east and west tunnel and subway from a point in or under the Park street station of the present subway, thence under Boston Common, Beacon Hill and the Charles River Embankment to a point between Massachusetts avenue and the junction of Commonwealth avenue, Brookline avenue, Beacon street and Deerfield street.

This act was approved June 28, 1907, and will be found in Appendix A.

In connection with this legislation, and at the request of the Committee on Metropolitan Affairs, the following communication was sent to the Legislature:

BOSTON, May 24, 1907.

To the Honorable Senate and House of Representatives in General Court Assembled.

The Boston Transit Commission respectfully submits the following report in compliance with the request contained in the following vote of the Committee on Metropolitan Affairs:

"VOTED, that in view of the fact that the Boston Transit Commission, in accordance with a resolve passed by the Legislature of 1905, submitted a report to the Legislature of 1906, contained in House Document No. 896 of that year, dealing with the subject of new subway construction for east and west traffic, a copy of the bill now before this committee entitled 'an act to provide for the construction of an east and west tunnel and subway in the City of Boston' be transmitted to said Commission with a request to report to the Legislature as soon as possible its views upon the route defined in said bill, and also upon the question whether the subway and tunnel provided for by said bill is more urgently required than the subway for surface cars to be located easterly of Washington street provided for by chapter 534 of the acts of 1902."

Chapter 48 of the resolves of the year 1905 requested this Commission, among other things, "to inquire into the subject of the further development of the subway systems of the city of Boston; the most advisable routes; whether further subways are necessary or desirable at the present time, or will be in the immediate future."

In its report made to the Legislature in compliance with this resolve, under date of January 19, 1906, the Commission stated its opinion that "it is evident that the needs of the present and immediate future require a further considerable increase in the facilities for traffic towards the west", and included among its conclusions the statement that "additional provision should be made without delay for the traffic towards the west"; and it specifically recommended that "a new line be constructed from near the junction of Commonwealth avenue and Beacon street to Park street."

The Commission further pointed out that "a new line may be built from the west, extending from near the junction of Beacon street and Commonwealth avenue, under Commonwealth avenue, or under one of the other streets between the river and Boylston street, or under or on the proposed embankment, with a subway extension, to a new station at Park street. This line would at first be used only for the cars running on Beacon street and Commonwealth avenue, which number is at present 66 in the maximum hour, but which should be greater to provide properly for present needs, and which should probably be doubled in a few years." It was also stated that "a further reason for the construction of this new line is the congestion at Park street station, which has already passed its proper limit. Such a line would carry the traffic from Brookline, Newton, Brighton, and parts of Cambridge, Watertown and Waltham, and would leave the Boylston street subway for the traffic from Cambridge, Ipswich street and Huntington avenue. * * * * Further engineering study will be necessary in order to determine definitely the relative merits of these routes."

The report contained figures showing that the population of the wards of Boston, and of the cities and towns within a radius of 10 miles from the State House, lying to the west of the center of the congested district of Boston, was over 300,000 according to the census of 1905, and that if the population continued to increase at the same rate as between 1895 and 1905, the inhabitants of this district would number 384,000 in the year 1915. The general conclusion of the Commission was that "it appears probable that in the next ten years the street car traffic in Boston will increase normally some 60% and will double in from 15 to 20 years." The proportionate increase is likely to be at least as large to the westward as in any other direction.

The Commission submitted with its report several alternative plans, one of which showed a subway and tunnel route beginning at Charlesgate West and having its terminal at the present Park street station. The route defined in the bill now before the Committee on Metropolitan Affairs differs from the route indicated upon this plan only as follows: The bill defines the route, beginning from the Park street station, "under Boston common substantially parallel to and adjoining or as a part of the tunnel authorized by chapter 520 of the acts of the year 1906, and under any other intervening public or private ways or lands to a point or points more than 100 feet distant from the common, thence in and under any intervening public or private ways or lands to a point or points in the Charles river embankment and park", whereas the route indicated upon the plan referred to ran from the Park street station under the Common to the corner of Charles street, thence under Beacon street to Beaver street and under the block of houses between Beaver and Otter streets to the embankment.

The tunnel under the Common and Beacon hill, authorized by chapter 520 of the acts of 1906, referred to in the bill, which is to connect the new Cambridge bridge with the Park street station, was located by vote of the Commission passed February 14, 1907, and therefore was not fixed at the date of the report to the Legislature.

The Commission is of opinion that, under existing conditions, the route defined by the bill between the Park street station "and a point or points at or near the westerly terminus of the embankment and the park at or near the Back Bay Fens", would be a desirable route for the accommodation of the present and future traffic from the west.

The Commission does not feel called upon to express any opinion upon the larger question whether this is a more desirable route for the proposed subway and tunnel for traffic to the west than a route under Commonwealth avenue, the Public Garden and the Common to the Park street station, or under some other street running parallel with Commonwealth avenue, for the reason that it believes that this question, involving as it does various considerations other than those relating purely to transit, is properly a legislative one which should be determined by the Legislature in the exercise of its discretion. The Commission only feels called upon, in response to the request addressed to it, to express its opinion that the route defined in the bill is a desirable one, that the construction of a subway and tunnel on such route is feasible, and that the same when constructed would afford the facilities for handling the traffic of the territory lying to the west of the center of Boston with greater speed which the Commission believes to be urgently needed.

To the question submitted "whether the subway and tunnel provided for by said bill is more urgently required than the subway for surface cars to be located easterly of Washington street, provided for by chapter 534 of the acts of 1902", the Commission replies that it believes that the existing need of a subway and tunnel on the route defined by the bill or on some parallel one will become very pressing before the same can be constructed, and that in view of the early completion of the Washington street tunnel, with stations permitting of the operation of trains of eight cars, the provision of additional facilities for traffic to the west is "more urgently required" than the construction of another subway running approximately parallel to the Washington street tunnel and the Tremont street subway.

The Commission desires to state that its Chairman, Hon. George G. Crocker, being absent has taken no part in the preparation of this reply.

(Signed) GEO. F. SWAIN,
THOMAS J. GARGAN,
HORACE G. ALLEN,
JOSIAH QUINCY,
} *Boston Transit Commission.*

CONGESTION OF TRAFFIC.

The Legislature of 1907 passed an act (Chapter 247, see Appendix B) requiring the Commission, when an appropriation should be made by the city government, to investigate the congestion and delay of teaming traffic, etc., and of the movement of freight within the city of Boston and to consider whether such congestion and delay can be relieved by the construction of freight subways. The City Council, by an order approved by the Mayor, June 15, appropriated $5,000 for such investigation. A force of engineers and observers for street work has been organized and conferences have been held with officials of the New York, New Haven & Hartford R. R. and Clinton White, of the Railroad Commission, who was formerly one of the Master Teamsters' Association in this city, and have been arranged with officials of the Boston & Maine R. R., the

Master Teamsters' Association, Armstrong Transfer Express Co., the hack interests and others.

Information as to congestion of traffic and street regulation of traffic has been asked by letter from New York, Buffalo, Philadelphia, Chicago, Cleveland, Cincinnati, St. Louis, Washington, Baltimore and Providence in this country and London, Liverpool and Manchester, England, Paris, France, Berlin, Germany, and Vienna, Austria.

It is probable that before the report of the Commission to the Legislature public hearings will be given on the matter.

TAKINGS BY EMINENT DOMAIN.

Up to March 20, 1907, takings by the Commission of easements and rights in real estate by eminent domain were permitted to be confined to portions or sections fixed by horizontal planes of division below or above, or at the surface of the soil. In takings for inclined entrances to subways or tunnels this limitation to horizontal planes necessitated the preparation of descriptions and plans which were as complicated as they were unique.

The Legislature of this year by Chapter 258 (Approved March 29, 1907, see Appendix C) authorized such takings to be bounded also by inclined planes or other surfaces and the legislation concerning the east and west tunnel and subway contains a similar provision.

TERM OF COMMISSION.

Chapter 213, Acts of 1906, extended the term of the Commission for three years from July 1st of that year, and on that date the Commission was organized by the re-election of George G. Crocker, Chairman, and B. Leighton Beal, Secretary. Howard A. Carson was reappointed as Chief Engineer.

Charles H. Dalton, one of the original members of the Commission, on June 28, 1906, sent a communication to His Honor the Mayor declining to serve for the extended term, his resignation to take effect upon the appointment and confirmation of his successor. Mr. Dalton continued to serve until Oct. 11, 1906, when he was replaced by Josiah Quincy, who had been appointed by His Honor the Mayor and confirmed by the Board of Aldermen.

JAMESTOWN EXPOSITION.

The Commission has caused the exhibit which had been at Buffalo, St. Louis, and the Lewis & Clark Expositions to be brought up to date and sent to the Jamestown Exposition.

SINKING FUNDS.

The following is the condition of the debt and of the sinking funds for the various divisions of the work of the Commission at the date of this report:

SUBWAY (INCLUDING ALTERATIONS.)

(*Debt*, $4,416,000, *outside debt limit.*)

Amount of fund, July 1, 1906		$852,741.01
Interest on bank deposits, July 1, 1906, to date	$689.91	
Interest on investments, July 1, 1906, to date	36,551.34	
Revenue, etc., July 1, 1906, to date	57,617.95	
		94,859.20
		$947,600.21

CHARLESTOWN BRIDGE, NO. 1.

(*Debt*, $750,000, *inside debt limit.*)

Amount of fund, July 1, 1906		$121,292.05
Interest on bank deposits, July 1, 1906, to date	$206.02	
Interest on investments, July 1, 1906, to date	5,894.50	
Requirement for debt	8,611.00	
		14,711.52
		$136,003.57

CHARLESTOWN BRIDGE, NO. 2.

(*Debt*, $805,000, *outside debt limit.*)

Amount of fund, July 1, 1906		$132,718.85
Interest on bank deposits, July 1, 1906, to date	$204.28	
Interest on investments, July 1, 1906, to date	4,984.00	
Revenue, etc., July 1, 1906, to date	21,401.46	
Requirement for debt	7,791.00	
		34,380.74
		$167,099.59

EAST BOSTON TUNNEL.

(*Debt*, $3,193,000, *outside debt limit.*)

Amount of fund, July 1, 1906		$78,461.44
Interest on bank deposits, July 1, 1906, to date	$285.85	
Interest on investments, July 1, 1906, to date	3,738.37	
Revenue, etc., July 1, 1906, to date	45,930.63	
		49,954.85
		$128,416.29

BOSTON TUNNEL AND SUBWAY.

(*Debt*, $4,956,700, *outside debt limit.*)

Amount of fund, July 1, 1906		$33,083.32
Interest on bank deposits, July 1, 1906, to date	$203.41	
Interest on investments, July 1, 1906, to date	1,770.90	
Revenue, etc., July 1, 1906, to date	19,217.63	
Premium, sale of bonds	17,770.00	
		38,961.94
		$72,045.26

AMOUNTS PAID FOR RENTAL OF THE SUBWAY.

The following sums have been paid during the year by the Boston Elevated Railway Company for the use of the subway:

Sept. 30, 1906:		
Net cost of subway	$4,100,551.35	
One quarter's rental		$49,975.47
Alterations: net cost	242,673.93	
One quarter's rental		2,957.59
Dec. 31, 1906:		
Net cost of subway	4,100,551.35	
One quarter's rental		49,975.47
Alterations: net cost	242,673.93	
One quarter's rental		2,957.59
March 31, 1907:		
Net cost of subway	4,100,551.35	
One quarter's rental		49,975.47
Alterations: net cost	242,673.93	
One quarter's rental		2,957.59
June 30, 1907:		
Net cost of subway	4,100 551.35	
One quarter's rental		49,975.47
Alterations: net cost	242,673.93	
One quarter's rental		2,957.59
		$211,732.24
Received on toll account		5,691.85

STATEMENT OF EXPENSES.

The following is a classified statement of the expenses of the Commission for the year ending June 30, 1907:

SUBWAY.

SECTION SIX.

Field supplies	$47.00	$47.00

EAST BOSTON TUNNEL.

ENGINEERING DEPARTMENT.

Rooms—Supplies	$3.00	
Field supplies	1.54	
Skilled service	200.85	205.39

SECTION B.

Whittier Machine Company (Contract No. 203)	$5,050.00	
Daniel J. Kiley (Contract No. 246)	25.96	
Proprietors of Long Wharf, Judgment	92,090.79	
Construction	546.05	
Field supplies	2,800.60	
Labor	40.37	
Legal and expert advice	3,346.00	
Stenographers	321.33	
Teaming	1.13	
Water pipes	896.37	105,118.60

SECTION C.

Daniel J. Kiley (Contract No. 246)	$18.19	
Labor	76.76	
Skilled service	27.25	
Teaming	12.09	
	$134.29	

CREDIT.

Construction	118.02	16.27

SECTION D.

Daniel J. Kiley (Contract No. 246)	$36.80	36.80

SECTION E.

Construction	164.50	164.50
Carried forward		$105,588.56

Brought forward		$105,588.56

SECTION F.

Construction	$24.83	
Field supplies	492.90	
Labor	119.90	
Skilled service	40.00	
Teaming	4.43	
		682.06

BOSTON TUNNEL AND SUBWAY.

General Expenses:		
Office—Furniture	$38.75	
Lighting	66.75	
Printing	354.15	
Rental	3,000.00	
Repairs	16.49	
Stationery-supplies	466.41	
Telephone-telegraph	200.20	
Stenographers	2,497.04	
Messenger	936.00	
Clerks	952.00	
Salaries of Commissioners and Secretary	26,249.33	
		34,777.12

ENGINEERING DEPARTMENT.

Rooms—Fuel	$106.09	
Furniture	137.40	
Lighting	527.21	
Printing	1,046.13	
Rental	3,000.00	
Repairs	9.11	
Stationery-supplies	1,760.58	
Telephone-telegraph	246.58	
Travel	41.60	
		6,874.70

MISCELLANEOUS.

Advertising		$22.12	
Borings:			
Labor	$475.18		
Materials	14.66		
		489.84	
Chief Engineer		12,000.00	
Field supplies		107.71	
Inspection		41.06	
Instruments		323.23	
Insurance		115.00	
Labor		1,353.11	
Messengers		2,622.87	
Legal and expert advice		895.00	
Skilled service		42,903.13	
Stenographers		3,079.71	
Stock		16,646.48	
Teaming		9.86	
Carried forward		$80,609.12	$147,922.44

Brought forward	$80,609.12	$147,922.44
Testing	841.94	
Tools	709.16	
		82,160.22

SECTION ONE.

(From westerly side of Ash street opposite Nassau street to a point in Washington street near southerly side of Eliot and Kneeland streets.)

Patrick McGovern (Contract No. 220)	$2,809.75	
Alterations	53.68	
Change of grade	2,525.40	
Construction	278.82	
Field supplies	221.72	
Labor	4,003.02	
Lighting	147.84	
Paving	290.11	
Protection of Tenants	14.05	
Skilled service	149.54	
Teaming	25.16	
Water pipes	2.78	
		10,521.87

SECTION TWO.

(From near the southerly side of Eliot and Kneeland streets to near the northerly side of Boylston street.)

Patrick McGovern (Contract No. 221)	$5,940.59	
Alterations	28.73	
Boylston street station:		
Miscellaneous	1,158.44	
Construction	799.12	
Damages	1,261.04	
Field supplies	304.46	
Labor	6,340.95	
LaGrange street station:		
Patrick McGovern (Contract No. 253)	3,194.93	
Martin Flynn (Contract No. 265)	1,793.70	
Miscellaneous	2,808.55	
Lighting	291.51	
Paving	3,025.52	
Skilled service	650.63	
Stationery-supplies	4.03	
Teaming	25.53	
Tools	166.93	
Water pipes	1,855.56	
	$29,650.22	

CREDIT.

Gow & Palmer (Contract No. 211)	1.32	29,648.90
Carried forward		$270,253.43

Brought forward		$270,253.43

SECTION THREE.

(*From near the northerly side of Boylston street to about* 30 *feet north of the northerly side of Hayward place.*)

Alterations	$74.21	
Construction	840.86	
Damages	500.00	
Essex street station:		
Hugh Nawn Contracting Company (Contract No. 283)	9,690.19	
Miscellaneous	2,942.66	
Field supplies	10.05	
Hayward place station:		
Miscellaneous	522.00	
Labor	3,251.00	
Lighting	70.10	
Paving	3,399.87	
Legal and expert advice	300.00	
Property Damages: Takings	160,610.43	
Protection of tenants	83.84	
Skilled service	822.05	
Stationery-supplies	5.89	
Teaming	17.25	
Test pits	38.17	
Tools	6.38	
Water pipes	9.75	
	$183,194.70	

CREDIT.

Hugh Nawn Contracting Company (Contract No. 283.)	120.32	
		183,074.38

SECTION FOUR.

(*From about* 30 *feet north of Hayward place to about* 50 *feet south of Franklin street.*)

Alterations	$108.57	
Construction	603.39	
Damages	2,856.56	
Field supplies	26.39	
Insurance	50.10	
Labor	2,306.44	
Lighting	136.71	
Paving	11,596.61	
Protection of tenants	173.97	
Skilled service	682.61	
Stationery-supplies	2.00	
Summer street station:		
Hugh Nawn Contracting Company (Contract No. 234)	5,256.19	
New England Structural Company (Contract No. 261)	144.15	
Miscellaneous	2,020.40	
Carried forward	$25,964.09	$453,327.81

Brought forward	$25,964.09	$453,327.81
Telephone-telegraph	1.75	
Temple place station:		
Hugh Nawn Contracting Company (Contract No. 234)	3,643.64	
John E. Palmer (Contract No. 309)	5,227.41	
New England Structural Company (Contract No. 292)	3,242.48	
Miscellaneous	1,910.18	
Test pits	42.17	
Tools	.85	
Water pipes	475.55	
Winter street station:		
Miscellaneous	831.67	
	$41,339.79	

CREDIT.

Hugh Nawn Contracting Company (Contract No. 234)	280.42	
		41,059.37

SECTION FIVE.

(*From about* 50 *feet south of Franklin street to near Court avenue.*)

Coleman Brothers (Contract No. 240)	$17,191.28	
Alterations	97.80	
Construction	1,232.20	
Damages	167.00	
Electric conduits	392.07	
Field supplies	93.08	
Franklin street station:		
Patrick McGovern (Contract No. 289)	28,309.29	
H. P. Converse & Company (Contract No. 287)	2,542.00	
Miscellaneous	6,068.20	
Labor	1,882.07	
Land Damages: Takings	167,425.25	
Legal and expert advice	200.00	
Lighting	321.40	
Old South Meeting House station:		
Coleman Brothers (Contract No. 240)	12,073.45	
New England Structural Company (Contract No. 293)	1,863.56	
Fred A. Houdlette & Son (Contract No. 295)	964.43	
Miscellaneous	3,233.56	
Paving	3,914.71	
Protection of tenants	3.15	
Skilled service	2,064.09	
Stationary-supplies	48.83	
Telephone-telegraph	2.74	
Testing	8.28	
Travel	16.25	
Underpinning	112.52	
Water pipes	2,637.12	
Water street station:		
Coleman Brothers (Contract No. 240)	2,512.73	
Miscellaneous	839.91	256,216.97
Carried forward		$750,604.15

Brought forward		$750,604.15

SECTION SIX.

(From near Court avenue to the north side of the East Boston tunnel.)

Boston Bridge Works (Contract No. 298)	$2,140.86	
Patrick McGovern (Contract No. 308)	36,208.16	
Advertising	30.40	
Alterations	85.83	
Construction	5,116.79	
Damages	21.50	
Field supplies	41.61	
Labor	1,117.92	
Lighting	52.52	
Paving	4.42	
Protection of tenants	27.09	
Rental	6.94	
Skilled service	1,966.66	
Stationary-supplies	1.84	
Teaming	15.00	
Telephone-telegraph	19.73	
Test pits	92.29	
Tools	59.75	
Travel	6.00	
Water pipes	125.17	47,140.48

SECTION SEVEN.

(From the north side of the East Boston tunnel to 150 feet north of State street.)

H. P. Converse & Company (Contract No. 306)	$1,987.30	
Patrick McGovern (Contract No. 270)	1,015.15	
Patrick McGovern (Contract No. 273)	713.70	
Patrick McGovern (Contract No. 280)	1,458.60	
New England Structural Company (Contract No. 254)	90.29	
Alterations	255.06	
Construction	28,448.40	
Damages	50.83	
Fuel	531.42	
Field supplies	6,889.35	
Inspection	7.00	
Instruments	5.00	
Labor	48,106.82	
Legal and expert advice	695.00	
Lighting	1,183.85	
Paving	148.89	
Protection of tenants	103.16	
Rental	6.94	
Skilled service	2,522.93	
Stationery-supplies	36.38	
Teaming	11,349.21	
Telephone-telegraph	30.24	
Testing	535.87	
Carried forward	$106,171.39	$797,744.63

Brought forward	$106,171.39	$797,744.63
Tools	2,545.61	
Travel	1.70	
Underpinning	2,747.72	
Water pipes	254.52	
		111,720.94

SECTION EIGHT.

(*From* 150 *feet north of State street to Hanover street.*)

Patrick McGovern (Contract No. 257)	$228,999.00	
New England Structural Company (Contract No. 254)	303.69	
Adams square station:		
Patrick McGovern (Contract No. 284)	25,108.65	
Miscellaneous	3,263.26	
Alterations	1,750.80	
Construction	28,371.64	
Damages	3,707.36	
Field supplies	10.23	
Inspection	31.73	
Instruments	3.90	
Insurance	122.42	
Labor	1,925.47	
Legal and expert advice	262.50	
Lighting	154.35	
Paving	580.84	
Portland street sewer:		
Coleman Brothers (Contract No. 258)	4,297.08	
Protection of tenants	272.39	
Skilled service	2,888.24	
Stationery-supplies	47.56	
Telephone-telegraph	25.75	
Tools	129.40	
Water pipes	1,291.09	
	$303,547.35	

CREDIT.

Portland street sewer:		
Miscellaneous	72.03	303,475.32

SECTION NINE.

(*From Hanover street to Haymarket square.*)

H. P. Converse & Company (Contract No. 259)	$3,941.47	
Coughlan & Sheils, Assignees, (Contract No. 263)	231,793.33	
New England Structural Company (Contract No. 256)	24,844.98	
Alterations	3,937.92	
Construction	30,557.08	
Damages	3,936.13	
Field supplies	71.04	
Inspection	136.02	
Instruments	11.00	
Labor	2,285.36	
Legal and expert advice	262.50	
Carried forward	$301,776.83	$1,212,940.89

Brought forward	$301,776.83	$1,212,940.89
Lighting	233.86	
Paving	27.97	
Printing	11.50	
Protection of tenants	261.01	
Rental	6.95	
Skilled service	4,987.80	
Stationery-supplies	53.80	
Teaming	7.75	
Telephone-telegraph	51.50	
Tools	220.98	
Union street station:		
Coughlan & Sheils, Assignees, (Contract No. 263)	10,100.04	
Miscellaneous	983.06	
Water pipes	19,243.20	337,966.25

SECTION TEN.

(*In Haymarket square for a length of about* 300 *feet, on the easterly side of the old subway.*)

Coleman Brothers (Contract No. 269)	$80,974.41	
New England Structural Company (Contract No. 264)	18,986.47	
New England Structural Company (Contract No. 267)	5,598.62	
Advertising	80.64	
Alterations	395.31	
Construction	8,238.87	
Field supplies	33.56	
Inspection	99.51	
Labor	990.93	
Lighting	6.35	
Paving	132.86	
Printing	125.40	
Skilled service	2,084.90	
Stationery-supplies	24.26	
Teaming	10.93	
Telephone-telegraph	38.03	
Test pits	39.68	
Water pipes	1,056.74	
		118,917.47

SECTION ELEVEN.

(*From the northerly end of Section Ten to portal of old subway.*)

Coleman Brothers (Contract No. 285)	$12,415.85	
New England Structural Company (Contract No. 272)	7,116.29	
Advertising	14.41	
Alterations	1,223.00	
Construction	2,641.51	
Field supplies	2.15	
Inspection	25.61	
Carried forward	$23,438.82	$1,669,824.61

Brought forward	$23,438.82	$1,669,824.61
Labor	234.81	
Lighting	14.10	
Printing	119.15	
Protection of tenants	126.75	
Skilled service	1,398.94	
Stationery-supplies	20.98	
Telephone-telegraph	16.50	
Water pipes	2.28	
		25,372.33

INVESTIGATION OF CONGESTION OF TRAFFIC, ETC.

Engineering Expenses:		
Skilled service	$10.30	
		10.30

INTEREST.

Boston Tunnel and Subway	$127,418.49	127,418.49
Grand Total		$1,822,625.73

SUMMARY.

	From beginning of work to June 30, 1906.	June 30, 1906 to June 30, 1907.	Total
Subway—Subway Commission	$14,131.16		$14,131.16
Part of General Expenses	117,473.24		117,473.24
Engineering and Miscellaneous	407,475.48		407,475.48
Section One	239,407.12		239,407.12
Two	363,605.50		363,605.50
Three	300,639.36		300,639.36
Three and one-half	9,355.70		9,355.70
Four	469,620.33		469,620.33
Five	388,894.69		388,894.69
Six	327,494.86	$47.00	327,541.86
Seven	231,504.27		231,504.27
Eight	95,635.96		95,635.96
Eight and one-half	76,639.47		76,639.47
Nine	299,452.07		299,452.07
Ten	254,497.88		254,497.88
Eleven	270,310.57		270,310.57
Interest	258,575.60		258,575.60
	$4,124,713.26	$47.00	$4,124,760.26
Transfer to Alterations see 11th report	4.95		4.95
Total	$4,124,708.31	$47.00	$4,124,755.31

	From beginning of work to June 30, 1906.	June 30, 1906 to June 30, 1907.	Total.
Alterations—Part of General Expenses	$28,945.53		$28,945.53
Section Three .	2,568.26		2,568.26
Four .	163.42		163.42
Five .	30,233.01		30,233.01
Seven .	178,516.16		178,516.16
Nine .	3.00		3.00
Ten .	534.04		534.04
Interest . .	1,905.56		1,905.56
Transfer from Subway—see 11th report .	4.95		4.95
Total .	$242,873.93		$242,873.93
Charlestown Bridge:			
Total .	$1,570,197.98		$1,570,197.98
East Boston Tunnel—Part of General Expenses . .	$161,010.72		$161,010.72
Engineering Expenses	175,696.79	$205.39	175,902.18
Section A . .	98,839.69		98,839.69
B . .	1,255,227.52	105,118.60	1,360,346.12
C . .	485,925.53	16.27	485,941.80
D . .	244,690.25	36.80	244,727.05
E . .	188,036.64	164.50	188,201.14
F . .	231,147.05	682.06	231,829.11
Interest . .	248,156.88		248,156.88
Total	$3,088,731.07	$106,223.62	$3,194,954.69
Boston Tunnel and Subway—Part of General Expenses . .	$108,540.10	$34,777.12	$143,317.22
Engineering Expenses	251,764.80	89,034.92	340,799.72
Section One . .	763,255.08	10,521.87	773,776.95
Two .	313,278.38	29,648.90	342,927.28
Three .	225,792.30	183,074.38	408,866.68
Four .	684,215.87	41,059.37	725,275.24
Five .	600,140.44	256,216.97	856,357.41
Six . .	2,849.50	47,140.48	49,989.98
Seven .	3,864.33	111,720.94	115,585.27
Eight .	143,053.81	303,475.32	446,529.13
Nine .	8,199.63	337,966.25	346,165.88
Ten . .	846.75	118,917.47	119,764.22
Eleven .		25,372.33	25,372.33
Interest . .	93,076.23	127,418.49	220,494.72
Total .	$3,198,877.22	$1,716,344.81	$4,915,222.03

	From beginning of work to June 30, 1906.	June 30, 1906 to June 30, 1907.	Total.
Investigation of Congestion of Traffic, etc:			
Total .		$10.30	$10.30
Grand Total . .	$12,225,388.51	$1,822,625.73	$14,048,014.24

The report of the Chief Engineer is appended.

GEORGE G. CROCKER, *CHARLES H. DALTON, THOMAS J. GARGAN, GEORGE F. SWAIN, HORACE G. ALLEN, †JOSIAH QUINCY.	*Boston Transit Commission.*

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*To Oct. 11, 1906.
†From Oct. 11, 1906.

REPORT OF THE CHIEF ENGINEER.

Boston, June 30, 1907.

George G. Crocker, Thomas J. Gargan, George F. Swain, Horace G. Allen, Josiah Quincy, *Boston Transit Commissioners.*

Gentlemen:—I submit herewith my report of work for the past year.

WASHINGTON-STREET TUNNEL.

The last annual report referred to the completion, within the year ending June 30, 1906, of most of the tunnel work on Sections 1 to 5, inclusive, extending from the southerly approach incline, near Bennet street, to Court avenue. At that date, the building in of spaces for lobbies under some of the side streets had been begun and the work of construction on Sections 8 and 9 was in progress.

During the year now under review Sections 8 and 9, the latter including a lobby between Washington and Union streets, near Haymarket square (shown on Plate 12 of last year's report), have been completed; work has been prosecuted on Sections 6 and 7, filling the gap, near State street, so long delayed by questions concerning entrances to and exits from the station in that locality; the old Subway in Haymarket square has been widened on its easterly side (Section 10) to form a joint structure with the new Tunnel; and the Tunnel has been extended from Section 10 to the northerly end of the wing of the Boston Hospital Relief Station, this work forming part of Section 11.

Among the construction items referred to above, the deep and intricate work on Sections 6 and 7, dealt with at length under separate headings, may be specially mentioned.

In addition to tunnel construction, entrances and exits have been built in Essex street, Franklin street and Adams square; an entrance and exit at Temple place is practically completed; those at the Old South Meeting House and Boylston street are well advanced and a contract has been let for similar work at Hayward place.

Some of the principal items of work, not begun at the date of this report (June 30, 1907), necessary for the completion of the Washington-street Tunnel, are as follows:

Changes in Haymarket-square Station to admit of the two tracks of the Washington-street Tunnel joining the two easterly tracks of the Subway and the addition of two tracks so as to make six in all, four for the Subway and two for the Washington-street Tunnel; the enlargement of the platforms of the Haymarket-square Station and the construction of a sub-passageway connecting them with the platforms of the Union-Friend Station, so as to provide for a large amount of transferring between the two stations; the extension of the added two tracks under the City Hospital Relief Station and the construction of an open incline northerly thereof. As the work under the Relief Station involves the loss, to that institution, of accommodations in the basement and on the street floor, it is proposed, in lieu of damages, to substitute other accommodations by erecting a wing on the Canal street side of the building.

The construction of ventilating ducts in portions of the tunnel arch in Sections 4 and 5; the protection of tie rods by concrete casings, and the construction of concrete buttresses between the high and low level tracks of Section 5 and of guard walls on the outer edge of the former.

The construction of stairways at the Union-Friend Station; the laying of stairway treads at LaGrange, Essex and Franklin streets, at Temple place and at Adams square; the laying of granolithic platforms and the tiling of walls, cove and ceiling surfaces in all stations and passageways.

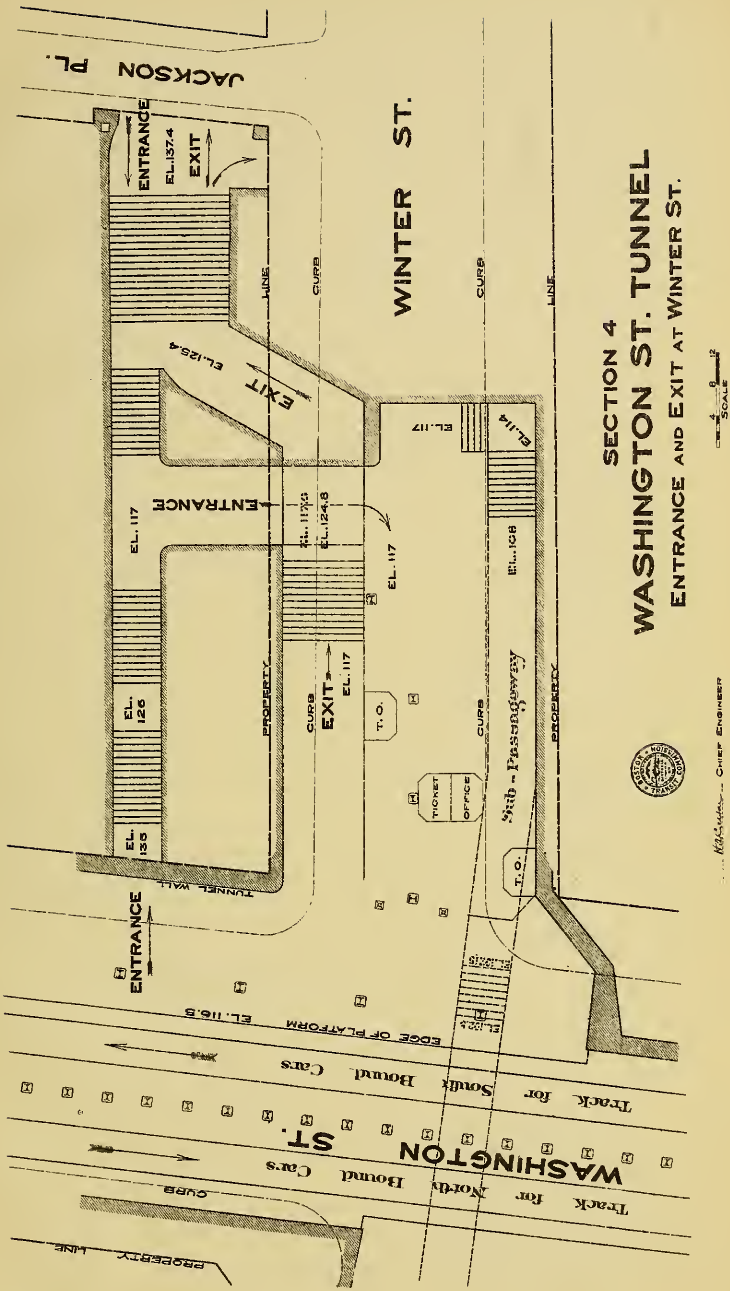
The building of entrances and exits at Winter street, at Summer street and at Water and Devonshire streets, and of facades, with indicator lanterns, etc., and the provision of hand rails, gates, etc., in all stations.

The erection of coverings over the two entrances and exits at Milk street station (Old South Meeting House) and over the entrance at Adams square.

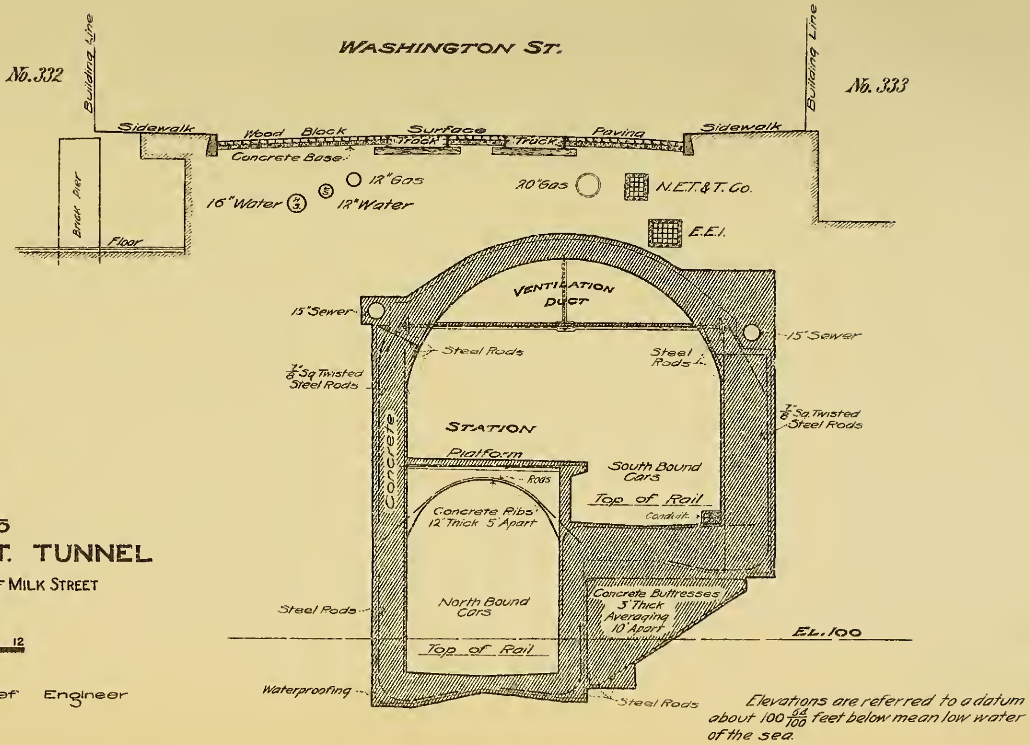
Observations and experiments, also, are required in regard to noise and other vibrations in the tunnel.

ENTRANCES AND EXITS.

The station entrances and exits for the Washington-street Tunnel are of two general types. In one of these, adopted at LaGrange street, Temple place and Franklin street, a broad stairway, divided in such proportions as may be found expedient, will serve both for entrance and exit. A landing, extending 6 feet inward from the sidewalk, leads to a 15-foot stairway descending about 8 feet in one straight flight to a landing below the street floor of the building. Passengers here make a half turn and descend by further steps to the lobby. The Temple place structure is shown on Plate 12 of the eleventh annual report.



SECTION 4
WASHINGTON ST. TUNNEL
ENTRANCE AND EXIT AT WINTER ST.



Elevations are referred to a datum about $100\frac{64}{100}$ feet below mean low water of the sea.

BOSTON TRANSIT COMMISSION

SECTION 5
WASHINGTON ST. TUNNEL

CROSS SECTION 52 FT. SOUTH OF MILK STREET
STA. 32+91

4 ft. 8 12
SCALE

H.A.Carson Chief Engineer

A modification of this type is used at the entrance and exit at the corner of Water and Devonshire streets. In this a turn is made, on a quadrant shaped landing, before descending the second flight. This brings the passenger to a 12-foot passageway extending under Water street for a distance of about 150 feet and connecting the entrance with the tunnel platform. The stairway and passageway are shown on Plate 8 of last year's (12th Annual) report.

The other type of structure provides, in each case, an entrance from Washington street and an exit, and sometimes an entrance also, on an adjacent side street. Thus, at Boylston street an 8-foot stairway will serve as entrance from Washington street and a 10-foot stairway as exit to Boylston street. At Hayward place, both stairways will be 10 feet wide. At Winter street, (Plate 1) the entrance stairway from Washington street will be 6 feet wide. Another stairway, 15 feet wide, at the corner of Winter street and Jackson place, will be suitably divided into entrance and exit. At Summer street, a somewhat similar arrangement includes an 8-foot entrance stairway from Washington street and a 13-foot exit and entrance stairway on Summer street. The latter will be divided so as to give access, from the street, to a 4-foot passage and stairway under Summer-street place, leading to the lobby. The Washington-street entrance stairway at Essex street is 8 feet wide and a 14-foot stairway on Essex street will be divided into a 4-foot entrance and a 10-foot exit. A 6-foot passage under the station tracks connects this station with the Boylston-street Station.

The space between the Old South Meeting House and the Old South Building has been utilized for two pairs of entrances and exits, near Washington and Milk streets respectively. The entrance and exit stairways are 7 feet wide in the former case and 5 feet wide in the latter. Provision has been made in Adams square, near Devonshire street, for a similar entrance and exit stairway for north-bound trains.

STATISTICAL TABLES.

The tables following page 28 give some of the facts in regard to work on Washington street, and in the following pages additional information is given which could not readily be tabulated.

No. 1.—CONSTRUCTION.

Section.	Location (From South to North).	Plates in This and Previous Annual Reports.	Assistant Engineer on Ground.	Contractor and Date of Contract.	Amount of Contract.	Appendices Showing Bids in This and Previous Annual Reports.	Date of Completion Named in Contract.
6. . . .	13 feet south of Court avenue to north side of State street.	. . . .	R. B. Farwell.	Patrick McGovern, April 10, 1907.	$182,935.00	XIII., S.	November 15, 1907.
7. . . .	147 feet northwards from the northerly wall of the East Boston Tunnel at Washington and State streets.	XIII., 3, 4. 5, 6.	G. D. Emerson.	Mostly Day Work.	Total cost, $107,600*	. . . .	June 29, 1907.
8	150 feet north of State street to center of Hanover street.	XII., 9.	R. B. Farwell.	Patrick McGovern, March 12, 1906.	310,267.50	XII., J.	December 31, 1906. (Certificate of completion, Nov. 27, 1906.)
9	Hanover street to Haymarket square.	XII., 10, 11, 12.	P. F. O'Brien.	J. J. Coughlan Construction Co., May 22, 1906.	198,275.00	XII., N.	January 31, 1907. (Certificate of completion, Feb. 3, 1907.)
Ticket Office. 9.	From No. 28 Washington street through to 90 Union street.	. . . .	P. F. O'Brien.	J. J. Coughlan Construction Co., January 18, 1907.	7,675.00	. . . . . .	Completed May 17, 1907.
10. . . . . (part of)	30 feet south of corner of Union and Blackstone streets, extending northerly about 300 feet.	. . . . .	R. B. Farwell.	Coleman Brothers, August 8, 1906.	84,856.00	XIII., G.	December 31, 1906. (Certificate of completion, Jan. 1, 1907.)
11. . . . . (part of)	End of Section 10 to northerly end of wing of Relief Station.	. . . .	R. B. Farwell	Coleman Brothers, November 12, 1906.	14,740.00	XIII., K.	January 15, 1907. (Certificate of completion, April 2, 1907.)
Boylston street entrance and exit.	No. 1 Boylston street; No. 641 Washington street.	. . . .	C. L. Brown.	Chas. R. Gow Co., May 18, 1907.	23,791.00	XIII., X.	August 30, 1907.
Essex street entrance and exits.	No 9 Essex street; 628 Washington street.	XI., 8.	P. F. O'Brien.	Hugh Nawn Contracting Co., October 25, 1906.	10,595.00	XIII., I	March 31, 1907. (Certificate of completion, March 27, 1907.)
Hayward place entrance and exit.	No. 6 Hayward place; No. 580 Washington street.	XI., 9.	J. T. Frame.	Chas. R. Gow Co., June 26, 1907.	9,867.00	XIII., Y.	September 1, 1907.
Temple place entrance and exit.	Nos. 57–59 Temple place.	XI., 12.	P. F. O'Brien.	John E. Palmer, April 24, 1907.	10,565.00	XIII., T.	July 15, 1907.
Franklin street entrance and exit.	No. 14 Franklin street.	. . . .	P. F. O'Brien.	Patrick McGovern, December 28, 1906.	29,087.00	XIII., M.	April 1, 1907. (Certificate of completion, March 16, 1907.)
Old South Meeting House entrances and exits.	Between Old South Building and Old South Meeting House, No. 312 Washington street.	. . . .	P. F. O'Brien.	Coleman Brothers, February 8, 1907.	20,592.00	XIII., Q.	May 15, 1907.
Adams square entrance.	150 feet north of State street to Adams square.	. . . .	R. B. Farwell.	Patrick McGovern, October 26, 1906.	24,615.00	XIII., J.	February 1, 1907. (Certificate of completion, Jan. 10, 1907.)

*Includes minor contracts amounting to $5,936.

No. 2.—PROGRESS OF CONSTRUCTION.

SECTION.	Dates of Beginning.		Dates of Completion.		Amount of Work Done, Year Ending June 30, 1907.		Total Amount of Work Done to and Including June 30, 1907, from Beginning of Work.		Number of Men Ordinarily Employed by the Contractor, Year Ending June 30, 1907.	
	Excavation.	Concrete.	Excavation.	Concrete.	Excavation in cu. yds.	Concrete in cu. yds.	Excavation in cu. yds.	Concrete in cu. yds.	Day.	Night.
6	April 12, 1907.	April 29, 1907.	. . . . .	. . . .	10,000	2,000	10,000	2,000	90	85
7	July 16, 1906.	July 16, 1906.	June 1, 1907.	June 29, 1907.	9,215	3,250	9,215	3,250	7 (3 shifts) 25 (3 shifts) 60	60 (2 shifts)
8	March 24, 1906.	April 4, 1906.	Nov. 16, 1906.	Nov. 23, 1906.	11,768	7,387	25,768	10,887	110	95
9	May 30, 1906.	June 10, 1906.	Jan. 22, 1907.	Feb. 3, 1907.	16,147	6,217	20,147	6,381	18	59
Ticket Office 9	(Cutting out masonry.) Feb. 19, 1907.	Feb. 27, 1907.	April 17, 1907.	May 17, 1907.	(Cutting out masonry.) 170	302	(Cutting out masonry.) 170	302	20	. . . . .
10 (part of)	Aug. 18, 1906.	Aug. 25, 1906.	Dec. 7, 1906.	Dec. 26, 1906.	9,494	2,072	9,494	2,072	85	70
11 (part of)	Nov. 17, 1906.	Jan. 4, 1907.	Jan. 8, 1907.	March 27, 1907.	265	263	265	263	30	20
Boylston street entrance and exit.	May 28, 1907.	June 2, 1907.	. . . .	. . . .	400	100	400	100	23	22
Essex street entrance and exits.	Dec. 2, 1906.	Dec. 18, 1906.	Feb. 21, 1907.	March 26, 1907.	468	450	468	450	20	1
Temple place entrance and exit.	May 2, 1907.	May 14, 1907.	May 25, 1907.	July 3, 1907.	. .	. . . .	. . . .	. . . .	20	10
Franklin street entrance and exit.	Jan. 1, 1907.	Jan. 21, 1907.	April 7, 1907.	May 3, 1907.	3,594	1,308	3,594	1,308	40	1
Old South Meeting House entrances and exits.	Feb. 15, 1907.	March 14, 1907.	April 22, 1907.	July 19, 1907.	1,770	721	1,770	721	20	12
Adams square entrance.	Nov. 1, 1906.	Nov. 12, 1906.	Dec. 15, 1906.	Jan. 4, 1907.	1,445	629	1,445	629	30	20

No. 3.—EXCAVATION DATA.

Section.	CHARACTER OF EARTH FOUND IN EXCAVATION.	Disposition of Surplus.
6	Mostly sand and gravel; some clay. No water.	Charles River Embankment.
7	Gravel, sand and clay; water at depth of 30 feet below surface.	Charles River Embankment.
8	South of Brattle Street, mostly sand and gravel, some clay; north of Brattle street, mostly clay with a little sand and gravel. Considerable water south of Cornhill at depth of about 30 feet; but little water north of Cornhill.	To scow and out to sea.
9	Below cellar floors stiff blue clay; very little water.	July 1 to Oct. 15, 1906, to scow at the Atlas Stores off Congress street.—Oct. 16, 1906, to June 30, 1907, to Charles River Basin.
10 (part of)	For about 8 feet from the surface, sand and gravel filling; then, for about 12 feet, sand and gravel, with silt towards the bottom; then about 3 feet of peat; stiff clay below. Very little water.	To scow and out to sea. Charles River Embankment.
11 (part of)	Same as Section 10.	Charles River Embankment.
Boylston street entrance and exit.	Mostly clay; about a foot of sand at bottom, carrying considerable water.	Charles River Embankment.
Essex street entrance and exits.	Below basement floor, blue clay; very little water.	Charles River Embankment.
Temple place entrance and exit.	Fine sand and gravel. No water.	Charles River Embankment.
Franklin street entrance and exit.	Sand and gravel; bottom stiff blue clay. Very little water.	Charles River Embankment.
Old South Meeting House entrances and exits.	Sand and gravel; no water.	Charles River Embankment.
Adams square entrance.	Mostly sand and gravel; some clay. No water.	Charles River Embankment.

No. 4.—STEELWORK.

Section.	Contractor for Furnishing Steelwork (Year ending June 30, 1907), and Date of Contract.		Amount of Contract.	Date of Completion Named in Contract.	Date of Certificate of Completion.
6	Boston Bridge Works,	Feb.19, 1907.	$2,095.00	April 2, 1907.	March 8, 1907.
	Eastern Bridge & Structural Co.,	Feb. 28, 1907.	13,694.40	1st Instalment Apr. 25, 1907. 2d " May 23, 1907. 3d " May 23, 1907.	
7	H. P. Converse & Co.,	March 9, 1907.	1,987.30	May 6, 1907.	May 2, 1907.
9	N. E. Structural Co.,	March 7, 1906.	28,575.00	June 26, 1906.	July 27, 1906.
	Additional,	April 3, 1906.	4,500.00	July 1, 1906.	
Ticket Office. 9	H. P. Converse & Co.,	May 8, 1906.	2,200.00	July 14, 1906.	Sept. 10, 1906.
10	N. E. Structural Co.,	June 8, 1906. Aug. 3, 1906.	11,213.64 5,340.00	Aug. 4, 1906. Oct. 1, 1906.	Oct. 31, 1906. Nov 9, 1906.
11	Boston Bridge Works,	Aug. 31, 1906.	1,734.60	Sept. 21, 1st part; Sept. 28, Remainder.	Dec. 7, 1906. Jan. 30, 1907.
	N. E. Structural Co.,	Sept. 13, 1906.	6,299.20	Nov. 17, 1906.	
Boylston street entrance and exit.	Boston Bridge Works,	April 27, 1907.	460.56	June 1, 1907.	May 8, 1907.
Essex street entrance and exits.	Boston Bridge Works,	Oct. 5, 1906.	872.10 (Amount paid.)	Nov. 1, 1906.	Dec. 8, 1906.
Hayward place entrance and exit.	N. E. Structural Co.,	May 20, 1907.	2,185.00	July 15, 1907.	June 25, 1907.
Temple place entrance and exit.	N. E. Structural Co.,	Jan. 28, 1907.	3,173.12	March 1, 1907.	Feb. 27, 1907.
Winter street entrance and exit.	N. E. Structural Co.,	May 27, 1907.	3,766.00	July 15, 1907.	....
Franklin street entrance and exit.	H. P. Converse & Co.,	Dec. 5, 1906.	2,244.75	Feb. 1, 1907.	Feb. 19, 1907.
Old South Meeting House entrances and exits.	N. E. Structural Co.,	Jan. 28, 1907.	1,800.00	March 1, 1907.	Feb. 16, 1907.

Section 6 of the Washington-street Tunnel.

Note.—For tabulated data see tables following page 28.

General Description of Structure.—Section 6 comprises the greater part of the State-street Station—a single-platform station for north-bound trains. It is connected by stairways and passageways with the platforms of the Devonshire-street Station of the East Boston Tunnel and has common entrances therewith through the easterly part of the Old State House. A passageway over the platform connects with the platform near Water and Milk streets for south-bound cars. Thus, through the entrances in the basement of the Old State House, one can reach cars going north, south, east and west. The tunnel tracks and a considerable part of the platform are covered by an arch 35 ft. wide internally, rising to a height of 32 feet above the north-bound track.

Details of Construction.—Along the Sears Building, the front wall of which was approximately 6 feet from the trench, excavation was made in pockets 6 feet in length, in which corresponding lengths of side wall were built before the adjoining pocket was excavated. The other buildings on Washington street, closely adjacent to the tunnel excavation, were underpinned first and the adjacent tunnel wall then built. At this date, (June 30, 1907,) the tunnel walls are nearly finished; excavation for and construction of the approaches and platform in State street and under the Old State House are in progress. Work on the arch is about to be begun and will be followed by the removal of the earth core and the building of the invert. The bottom of the invert will be about 46 feet below the surface of the street.

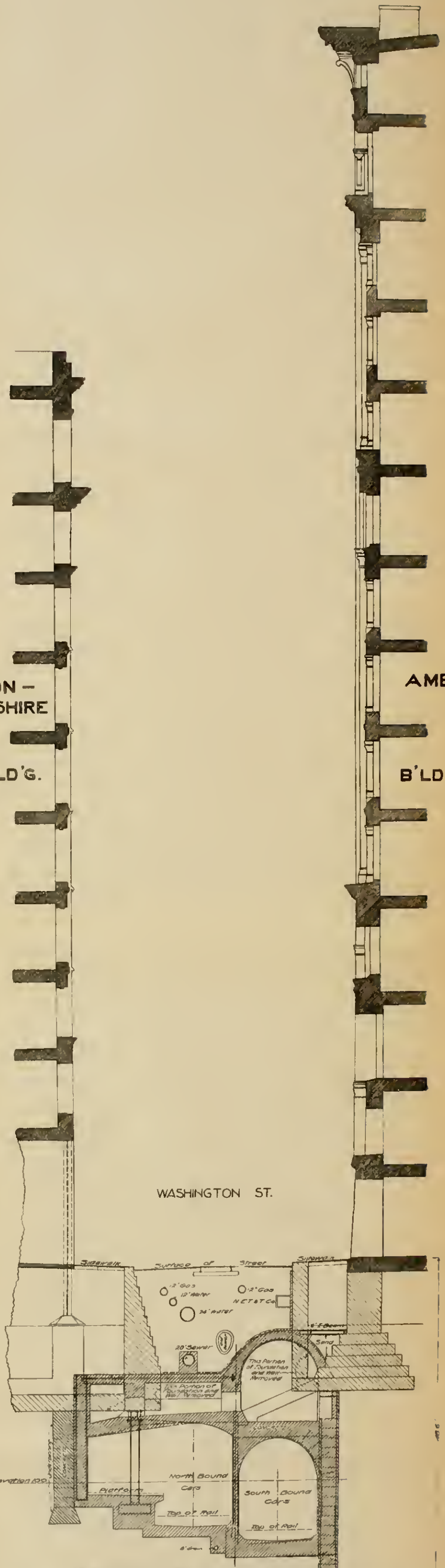
Section 7 of the Washington-street Tunnel.

Note.—For tabulated data see tables following page 28.
For plans and illustrations see plates 3, 4, 5 and 6.

Section 7 extends 147 feet north from the point where the northerly wall of the East Boston Tunnel crosses Washington street at State street. It is interesting mainly on account of its depth and its position with relation to important buildings, especially the Ames Building.

The Ames Building has a height of over 200 feet above the earth on which its foundations rest. It is not a steel frame building, although its floors are made of steel and masonry. The street walls are of stone with brick backing and are so thick as to bring a weight on the underlying earth as great, probably, as would be given by a modern steel building (other conditions remaining the same) having a height of over 280 feet. The alignment of the Washington-street Tunnel and the need of a passenger station in this vicinity required that the westerly wall of the Tunnel at the Ames Building should substantially coincide with the westerly building line of the street. The bottom of the tunnel masonry was to be 28 feet below the foundations of the building and 48 feet below the sidewalk level. The foundations of this building, however, project into the street practically the whole width of the sidewalk. Consequently, unless the encroaching foundations should be removed the tunnel would have to be built under them and a considerable portion of the weight of the building would rest on the top of the tunnel. The conditions are indicated by Plate 3. The cross-section shown on this is taken not far from the middle of the building. South of this the foundation footings project over the tunnel to a greater and to the north of this section to a less distance over the tunnel than is shown on this plate. The Transit Commission asked the trustees of the building to remove the encroaching foundations. After some discussion, it was decided to allow them to remain.

A question which early presented itself was whether the whole area of the foundation supporting the Washington-street wall should receive a new masonry support, *i. e.*, underpinning, to be carried down to the bottom of the Subway excavation, or whether only so much excavation should be made as was necessary for the displacement of the Subway. An objection to the latter plan was that even with great care and skill some of the earth to the west of the Subway and underlying and supporting the remaining portion of the street wall of the building might be disturbed. If the former plan was adopted, however, the earth lying still farther west and underlying the foundation masonry of the first row of piers might be disturbed. Mr. Isaac Blair and Mr. Wm. H. Cavanagh, who have had extensive experience in underpinning and supporting buildings in Boston, were consulted, as well as other engineers. Some preferred one plan and some the other. Mr. John E. Cheney, however, a civil engineer of long experience and high standing, who until the time of



WASHINGTON ST. TUNNEL.

CROSS SECTION 50 FT. NORTH OF COURT ST.

STA. 41+90

0 10 20 30
Scale of Feet

Chief Engineer

his death in September, 1906, was engineering adviser of the trustees of the Ames Estate in this matter, strongly favored the latter general plan and asked that so much of the building as was formerly supported within the street lines be supported on top of the Tunnel. Mr. Cheney did not work out any details for carrying out this idea but he approved of those which were finally worked out and which were partially carried into effect prior to his death. Mr. Frederick H. Fay, who had assisted Mr. Cheney in studying the weight of the building and its distribution, advised the trustees after Mr. Cheney's death.

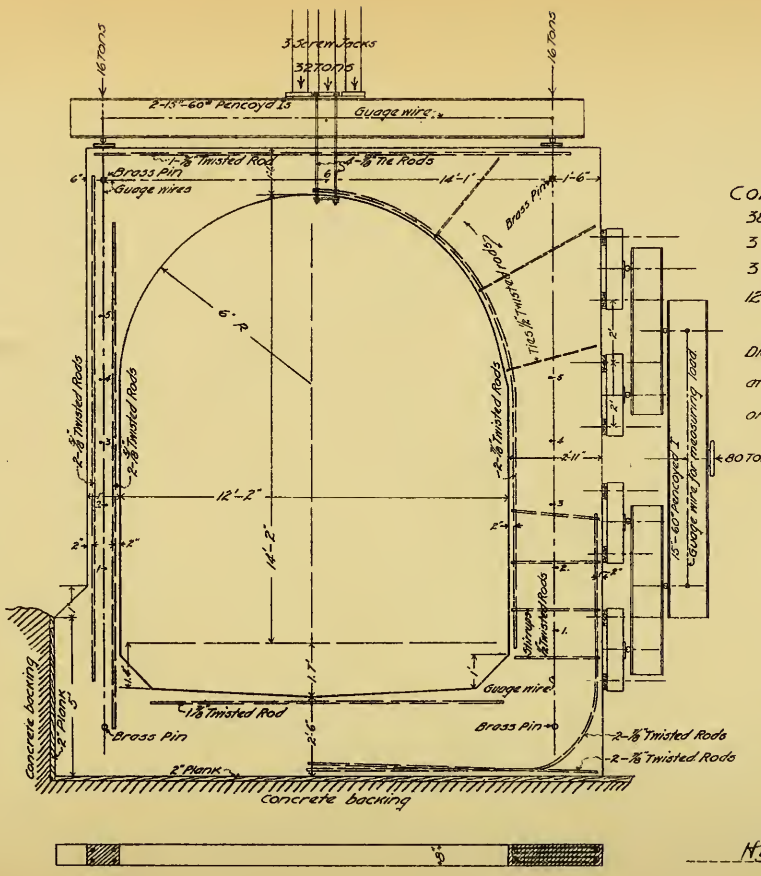
After discussion, the Transit Commission determined to adopt the general scheme favored by the engineering representative of the trustees of the Ames Estate, and the details of this were accordingly worked out and carried into execution.

In furtherance of this plan it was at first proposed to make the westerly wall of the Tunnel of a row of metal or other pipes to be forced down by jacks reacting upward against the foundations of the building, these pipes being about three feet in diameter and touching each other. For various reasons, however, this idea was abandoned and details were worked out which did not embody any novel feature of this plan. The westerly wall was formed of a series of hollow piers, each one being begun at the top, *i. e.*, immediately under the foundation, and extended downward, step by step, to the bottom of the tunnel wall. The piers were made hollow in their earlier stages, so that excavation could be carried on inside of them and for the further reason that it was necessary to unite, as a monolith, the reinforced masonry of the arch and invert with the masonry which would finally fill the hollow piers and constitute a large part of the westerly wall of the tunnel. The details are given in the following paragraphs.

A trench was first excavated along the front of the building to the bottom of the foundation. A drift about 4 feet wide and 4 feet high was then driven under the foundation, at right angles to the trench, to the back of the proposed tunnel wall. A row of jacks was placed on each side of this drift to make up as far as possible for the supporting power of the excavated earth. At the farther end of this drift, on the line of the tunnel wall, a vertical rectangular shaft, 3 feet x 3 feet 9 inches in cross-section, was driven down to about 3 feet below the grade of the bottom of the tunnel invert. As the shaft was driven, its walls were made of concrete slabs reinforced with embedded steel angles and rods, forming a hollow pier. The slabs were fastened together vertically and horizontally by splicing angles bolted in the inside corners of the shaft. Steel foot plates were driven out from the interior of the bottom of the pier so as to project 9 inches beyond the outer edges of the shaft lining at right angles to the tunnel wall, temporarily increasing the footing area until additional supporting area was supplied by the construction of the tunnel invert. After plugging the bottom of the pier with about 3 feet of concrete, the proper portion of the load of the building was transferred to the pier by driving steel wedges between the bottom of the building foundation and steel I-beams bedded on top of the pier walks or lining. The wedges were so placed that the load was carried through the transverse walls and the back wall of each pier, leaving the wall on the tunnel side unloaded, as the method used involved taking out some of the face slabs, as stated later on.

As soon as the first hollow pier was completed and the proper load transferred to its footing, a parallel drift was dug and a second pier, touching the first, was built in the same manner. This process was continued, forming a cellular wall 3 feet thick. All void spaces around and between the piers were filled with grout. Thirty-four of these hollow piers were put down, twenty-five of which were directly under the building foundations. For about one-third of the piers, where the ground was soft, rectangular steel shields about 3 feet deep were used. These were jacked down as the excavation proceeded, the concrete slabs being bolted in place behind them in a manner similar to that employed in ordinary shield tunnelling. The shields were left in place at the bottom of the pier. If they should turn into rust they will still be more solid than the earth which they replace. After the entire combined underpinning and tunnel wall was in place the westerly barrel of the tunnel was built in sections 7 to 8 feet long. Some of the concrete slabs were removed from the face of the underpinning wall where it was joined by the tunnel arch and invert, thus allowing the steel reinforcing rods from the arch and invert to be carried through the openings into the hollow piers. These piers were filled with concrete when placing the concrete for the invert and arch,

PLATE 4.



CONCRETE MIXTURE
380# Vulcanite Cement
3 Cubic Feet Sand
3 Cubic Feet Stone Dust
12 Cubic Feet Broken Stone

Distortion measurments taken at points 1, 2, 3, 4, 5, 6 also diagonals between brass corner pins.

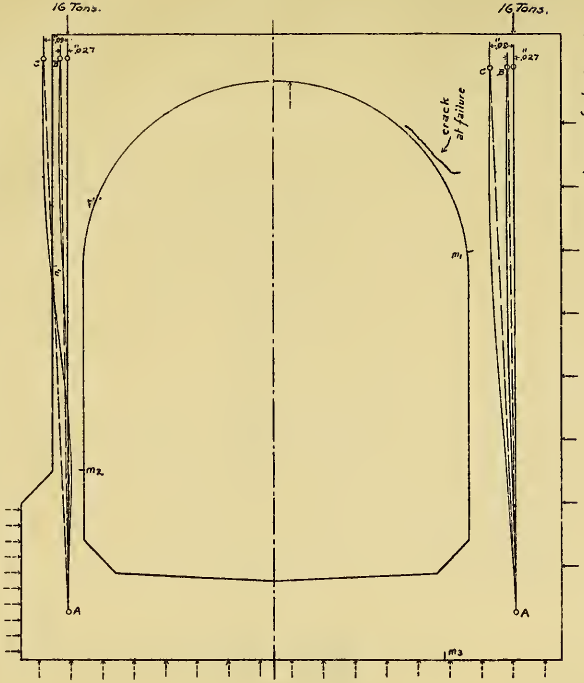
BOSTON TRANSIT COMMISSION

TEST SECTION
WASHINGTON ST. TUNNEL
SECTION 7.

0 1 FT. 2 3 4 5
SCALE

Chief Engineer

PLATE 5.



Date	Total distributed load on side, 8 points of application: Gross	Friction Estimates	Net	Remarks
1906				
June 8				Section made
July 3	19 tons	3 ½ weight of sliding parts	16 Tons	
Sept. 19	17.6 "	3	14.6 "	Deflection Curves AB
" 19	31 "	3	28. "	" " AC No cracks observable at this load
Sept. 22	41 "	4	37 "	
	Fine cracks about an inch long started at points marked M1 - M2 etc., in the order named between net loads of 30 and 35 tons			
Oct. 5	At net load of about 40 tons a fine crack at N1			
	55	7	48	Failure

Reinforcing rods pulled away from the concrete body of the wall between ties as indicated by crack on diagram. The section still carried the load after break in concrete. The cracks in the tension face of the concrete at m1 - m2 etc. remained fine (less than .02" wide) indicating that the steel did not reach its yield point.

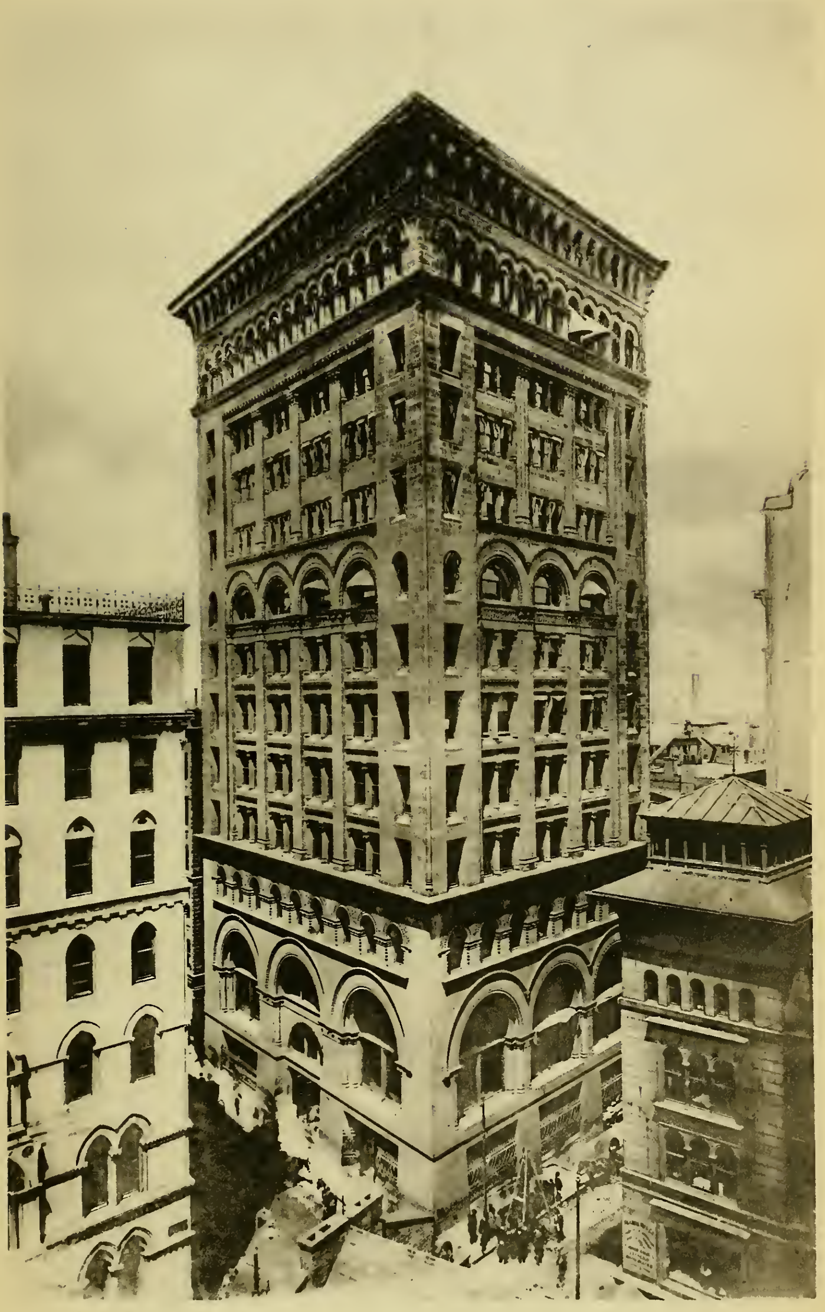
DIAGRAM SHOWING
DEFORMATIONS IN TEST SECTION
WASHINGTON ST. TUNNEL
SECTION 7

0 1 Ft. 2 3 4 5
Scale

Deformations exaggerated 100 times.

BOSTON TRANSIT COMMISSION

H.A. Carson Chief Engineer



GEORGE E. LAWRENCE CO. PHOTOGRAPHER.

WASHINGTON AND COURT STREET SIDES OF THE AMES BUILDING.
LOOKING NORTH.

COCKAYNE, BOSTON

thus making the pier filling monolithic with the rest of the tunnel section, as shown on Plate 3.

This method, with some modifications to suit the different conditions, was later used to underpin the Washington-street front of the Devonshire Building on the opposite side of the street.

Owing to the unusual problems involved and the consequent desirability of being able to alter the plans or vary methods at any stage of the work, the section was built almost entirely by day labor under the direct control of the Engineering department. Several contractors, including Coleman Brothers and John E. Palmer, furnished men and tools for the work. A total of 9215 cubic yards of excavation and 3250 cubic yards of concrete was involved. Of the former, about 800 cubic yards was done under contract by Patrick McGovern.

The work of underpinning the Ames Building and the construction of the westerly barrel of the tunnel was carried on with three eight-hour shifts per day. The remainder of the section was then completed with two ten-hour shifts per day. The men were paid by the hour and expressed their wish to work at least ten hours per day.

Section 8 of the Washington-street Tunnel.

Note.—For tabulated data see tables following page 28.

The structural design of this two-arch section was fully described in the last annual report. Southerly from Cornhill, the buildings on the westerly side of Washington street were first underpinned and the Tunnel then constructed on the general lines of the "slice" method described in earlier reports. Through Adams square and under the old Subway the side walls were built in tunnel drifts; the core was then excavated in 12-foot lengths, measured longitudinally, followed by the building of the center wall, invert and arch in the order named. From Elm street to Hanover street the general method was to excavate a 16-foot length, sufficiently wide for the building of one side wall (usually the easterly), the center wall, and the connecting invert and arch; the buildings were temporarily supported on steel beams spanning the excavation. As soon as each short length of partial cross-section was sufficiently set, the adjacent building foundations were pinned up from it, the remaining width of the strip excavated and the other side wall and invert and arch constructed.

Section 9 of the Washington-street Tunnel.

Note.—For tabulated data see tables following page 28.

General Description of Structure.—This section consists of the Union-Friend Station, lying almost entirely under buildings, east of Washington street and south of Haymarket square, with two platforms, each 350 feet long and 12 feet wide, directly opposite each other. Under the northerly end of the platforms is a passageway leading to the present Haymarket-square Subway Station, which will be greatly enlarged, in the expectation that a large amount of transferring will take place here between the trolley cars of the old Subway and the trains for elevated service in the Washington-street Tunnel.

On each platform is a row of heavy steel columns, 12 feet on centers, supporting heavy longitudinal girders. Between the tracks there is a row of columns, 4 feet on centres, carrying intermediate longitudinal girders from which flat arches spring in each direction to the platform girders. These arches are reinforced with transverse 10-inch I-beams, 28 feet long and 1 foot on centres. The platforms are covered by flat concrete arches reinforced with steel rods. The roof over the central portion is left as thin as possible so as to save valuable space which future owners and tenants of the buildings may desire to utilize by distributing over the floors heavier loads than those hitherto used. The aim has been to afford considerable latitude in this respect by rendering possible the erection of columns transmitting such loads to the heavy columns, girders and foundations forming parts of the tunnel structure. The general arrangement of these has been designed to facilitate comprehensive changes in the present buildings, as by the addition of heavier stories, whenever the interests of owners call for extensions of this character.

Details of Construction.—The buildings were first supported and trenches then cut through so that side walls and rows of piers could be erected; the roof was then put on and, when thoroughly set, the buildings were underpinned onto it. The basements of four buildings were taken permanently; the remaining basements, in whole or in part, were taken only during construction and restored to the use of tenants on the completion of the tunnel roof. In one of these latter cases (Hight & Merrill, 100–102 Union street) it was necessary for the tenants to vacate the basement during construction, but in every other instance it was found possible to avoid substantial interference with business.

The entrances for stairways from 90 Union street and 30 Washington street and the lobby for ticket offices have been built and are ready for the finish to be put on.

The work on Union street was especially difficult on account of the heavy street traffic and the great number of pipes encountered, some of which were laid when the original Subway was built through Haymarket square.

But little water was encountered. The bottom of the invert in this section is about 7 feet below mean low water.

Section 10 of the Washington-street Tunnel.

Note.—For tabulated data see tables following page 28.

General Description of Structure.—The construction of this section, adjoining the original Subway, necessitated the removal of portions of the walls and roof of the latter. The new structure is essentially a widening of the Subway by the construction of a new wall at a mean distance of about 40 feet easterly from the Subway wall. Steel columns, ranging about 27 feet westerly of the new wall, directly support transverse beams extending from the new wall, and jack-arches between these form the main roof of the structure. The remaining strip of roof is formed by jack-arches between transverse girders having their westerly ends permanently connected with the steel roof-beams of the Subway.

Details of Construction.—The general method was first to excavate for and build the easterly wall, then to dig a longitudinal trench for the steel columns. After these were erected, excavations were carried sufficiently deep to place the roof beams in position. The operations of riveting, concreting the roof, digging out the core and constructing the invert followed in succession. At the northerly end of the section, for a distance of about 60 feet, the line of new columns will not be placed until just before the traffic is to be diverted from the Subway into the Tunnel, the Subway columns serving as supports in the meantime.

The only underpinning done was under a portion of the building at the northerly corner of Cross street and Washington street North.

Section 11 of the Washington-street Tunnel.

Note.—For tabulated data see tables following page 28.

General Description of Structure.—Work on this section included the connection of the easterly wall of Section 10 with the converging easterly wall of the Subway and the reconstruction of the Subway roof to meet the requirements of the new Tunnel. The new connecting wall was made of reinforced concrete 21 inches in thickness. The roof was formed of steel beams, spaced about 3 feet apart, with concrete jack-arches and covering.

Details of Construction.—This section is partly under the easterly wing of the Boston City Hospital Relief Station and the building was supported on steel needle beams, having their westerly ends resting on brick piers on the Subway roof and their easterly ends on steel columns carried up from the bottom of the Subway. A trench was dug for the tunnel wall; after the wall was built, the old roof was cut out in short lengths and replaced by corresponding lengths of new roof. The work on this section was delayed considerably by the winter weather.

RELOCATION OF PIPES.

Wherever openings have been made for tunnel construction, more or less complete relocations of the pipes and other underground objects have been made. The bulk of the work this year has been in and near Haymarket square, where all of the pipes, sewers and conduits, many of which had been previously located on account of the construction of the Subway were moved again for the Washington-street Tunnel.

By the use of closely spaced heavy roof girders and of pipe crossings between the roof beams, it was possible to provide a clear space of 2½ feet above the tunnel roof and to carry smaller pipes and electric conduits in new locations over the roof from the east side of Haymarket square into Washington street North. The larger water pipes and gas pipes were carried around the square through Hanover, Endicott and Stillman streets. The 24-inch water pipe which formerly crossed under the Subway at Haymarket square was abandoned at this point on account of the sub-passage between the Washington-street Tunnel and the Subway. Pipe galleries, to cross under the two subways, had been considered, but owing to objections by the Water Department and because there would be no appreciable saving in cost, the water pipe was carried around through side streets, as stated above. The size of this new 24-inch pipe was enlarged at Cross street to 36 inches at the request of the Water Department, which bore the additional expense, and this size was continued through Cross, Stillman and Haverhill streets to the corner of Travers street, where it was connected with an old 30-inch pipe.

The inverted sewer syphon built by the Transit Commission under the Subway at Haymarket square, which has been used only in emergencies since the construction of the Cross-street intercepting sewer, was abandoned and the sewers in Blackstone and Cross streets were connected.

In addition to the foregoing there has been the usual relocation of smaller sewers, gas and water pipes, conduits for electric wires, trolley poles, catch basins, etc., in the streets, and where the Tunnel has passed through private property there has been miscellaneous relocation of heating apparatus, elevator machinery, drain pipes, sewers, etc., in the basements in order to provide working room for the tunnel construction and to meet the changed conditions.

The work, as in the past, has been carried on largely outside of business hours so as to incommode the public as little as possible.

There have been no accidents of any magnitude during the past year on account of these changes.

THE CAMBRIDGE CONNECTION AND THE RIVERBANK SUBWAY.

Field surveys and compilations have been made for an underground connecting link between the Park-street Station of the original Subway and the proposed Cambridge Subway, including studies for stations under and near the Park-street Station. In these studies due consideration was given the proposed Riverbank Subway.

ASSISTANTS IN THE ENGINEERING DEPARTMENT.

Appendix D gives the names of those employed in the Engineering Department for more than a month during the past year. I desire to thank them for their faithful and intelligent service and for the valuable suggestions which they have made.

Respectfully submitted,

H. A. CARSON,

Chief Engineer.

APPENDIX A.

[Chapter 573.]

AN ACT TO PROVIDE FOR THE CONSTRUCTION OF AN EAST AND WEST TUNNEL AND SUBWAY IN THE CITY OF BOSTON.

Be it enacted, etc., as follows:

SECTION 1. The Boston transit commission, hereinafter called the commission, may construct in the city of Boston, hereinafter called the city, a tunnel and subway, to be designated as the Riverbank Subway, and hereinafter called the subway, so designed as to be adapted to contain two railway tracks, from a point or points in or under the existing Park street subway station, or any enlargement thereof, under Boston Common, and any other intervening public or private ways or lands, substantially parallel with and adjoining or as a part of the tunnel authorized by chapter five hundred and twenty of the acts of the year nineteen hundred and six, to a point or points more than one hundred feet distant from the Common; thence in and under any intervening public or private ways or lands to a point or points in the Charles River embankment and park provided for by chapter four hundred and sixty-five of the acts of the year nineteen hundred and three, as amended by chapter four hundred and two of the acts of the year nineteen hundred and six; thence westerly in and under said embankment and park to a point or points in said embankment or park west of Harvard bridge; thence in, under, over and across public ways and lands to a point or points in Beacon street at or near the Back Bay Fens, or to such point or points in Commonwealth avenue or Beacon street east of the junction of Commonwealth avenue, Beacon street, Brookline avenue and Deerfield street as the commission may determine after due notice to all the parties interested and a public hearing thereon, including suitable approaches, entrances, sidings, stations, elevators, inclines, cuts, loops, connections and other structures, including connections either at grade or otherwise with the existing Tremont street subway, and suitable terminals under the Common and Tremont street, and suitable connections with existing or other tracks.

Any tunnel or subway construction under or within one hundred feet of Boston Common shall be made, so far as practicable, water tight, and the work shall so be done as to avoid the draining of moisture from the surrounding soil, or other injury to the trees, and the commission may construct a suitable system of subsoil irrigation above and near the line of said subway within the Common, or may take any other measures which it may deem necessary or expedient for the preservation of the trees, to be paid for as a part of the cost of the subway. The commission shall design and construct any structures erected above the surface of the embankment and park aforesaid in such manner that they shall constitute the least practicable obstruction to the view.

SECTION 2. The commission shall immediately after the passage of this act make such preliminary investigations, surveys and plans as it deems expedient, and to that end may enter upon any lands or place and maintain marks therein, and may make excavations, borings and do all other acts necessary for such investigations and surveys, and may expend such sums as it deems necessary therefor. The expenses incurred in making such preliminary investigations, surveys and plans shall be deemed a part of the cost of the work.

The Charles river basin commission shall make such changes in its plans for constructing the embankment and park aforesaid, and the conduit, drains or other structures therein or appurtenant thereto, and in the construction thereof, as the transit commission may determine to be required in connection with the proper location and construction of the subway herein provided for, and shall postpone or omit any part of the work provided for by said chapter four hundred and sixty-five, as amended by said chapter four hundred and two, which it may be necessary or expedient to postpone or which may be rendered unnecessary by or in view of the work herein provided for· but no changes, postponements or omissions shall be made in respect to the shut-off dam or any part thereof, or in respect to the main marginal conduit as distinguished from the inflows, overflows and other connections therewith.

Section 3. The commission shall not begin the work of construction until it has filed in the office of the city engineer a plan signed by the commission showing the proposed route or the location thereof, and the general form and method of construction, the location of proposed tracks, stations and approaches, and the alignment and grade, which plan shall be submitted to the Boston Elevated Railway Company, hereinafter called the company, which term shall be deemed to include its successors and assigns, for its approval. Any such plan so filed may be altered at any time by a new plan signed and filed in like manner.

Section 4. The commission may make contracts in the name of the city for the work herein authorized, but all contracts involving two thousand dollars or more in amount shall be in writing and signed by a majority of the commission; and no such contract shall be altered except by an instrument in writing signed by the contractors and a majority of the commission, and also by the sureties, if any, on the bond given by the contractor for the completion of the original contract. No such contract or alteration of any such contract shall be valid or binding on the city unless executed in the manner aforesaid.

Section 5. All work done under this act under or near public streets and places shall be conducted, so far as may be practicable, in such manner as to leave such streets and places, or a reasonable part thereof, open for traffic between the hours of eight in the forenoon and six in the afternoon of each secular day, except public holidays.

Section 6. The commission may, for the purposes of this act, use public ways and lands, including the embankment and park aforesaid, without compensation therefor: *provided, however,* that any private owner of flats or land covered by tide water, taken under authority of chapter four hundred and sixty-five of the acts of the year nineteen hundred and three or chapter four hundred and two of the acts of the year nineteen hundred and six for that part of the embankment and park traversed by the subway, if entitled in law to additional compensation therefor in view of the use thereof authorized by this act, may recover the same from the city, in the manner provided by section eight of this act; and the commission may acquire for the city, by purchase or otherwise, or may take lands in fee and easements, estates, and rights in land, including the right to go under the surface thereof or through or under buildings or parts of buildings thereon, and such takings in fee or otherwise may be made whether the lands taken or otherwise affected are held under or by title derived under eminent domain or otherwise. A taking or purchase under this section of an easement or other estate or right in a given parcel of real estate, whether such parcel consists of unimproved land or of land and buildings, may be confined to a portion or section of such parcel fixed by planes of division or otherwise, below or above or at the surface of the soil, and in such case no taking need be made of upper or lower portions or other parts or sections thereof, except of such easements therein, if any, as the commission may deem necessary. The commission, to make any taking by right of eminent domain, shall cause to be recorded in the registry of deeds for the county of Suffolk a description of the lands, easements, estates or rights to be taken, as certain as is required in a common conveyance of land, with the statement that the same are taken under authority of this act, which description and statement shall be signed by the commission; and the lands, easements, estates or rights therein described shall upon such recording be taken for and shall vest in the city. The commission shall, so far as may be practicable, notify all known owners of such takings, but the validity thereof shall not be affected by want of such notice.

SECTION 7. The commission may sell the buildings and other structures upon any lands taken by it, or may remove the same, and shall sell, if a sale be practicable, or if not shall lease, any lands, or rights or interests in land or other property so taken, or purchased for the purposes of this act, whenever the same shall in the opinion of the commission cease to be needed for such purposes. The proceeds of such sales and leases and the fair valuation of any such lands or other property no longer needed for such purposes but not actually sold, shall be deducted from the cost of the subway for the purposes of ascertaining the rental thereof.

SECTION 8. The commission shall determine and award the damages sustained by any person by reason of property taken or injured by the commission under authority of this act, except public ways or lands, and except the embankment and park aforesaid, and may agree with any person as to the amount to be paid as damages sustained by him for any property so taken or injured, which damages the city shall be liable to pay. If such person is dissatisfied with such award, or cannot agree with the commission upon his damages, the same may be determined by a jury in the superior court for the county of Suffolk, on petition therefor of such person or of the commission, in which case such person shall be joined as a petitioner against the city, filed in the clerk's office within one year after such property is so taken or injured; and judgment shall be entered upon the determination of the jury, and costs shall be taxed and execution issued in favor of the prevailing party as in other civil cases. The members of the commision shall not be liable personally for any such damage. In a determination made under the provisions of section twelve of chapter four hundred and sixty-five of the acts of the year nineteen hundred and three, as amended by section four of chapter four hundred and two of the acts of the year nineteen hundred and six, of the value of the benefit or advantage from the establishment of the embankment and park therein mentioned to any parcel of real estate bordering upon or near said embankment and park, the fact that said embankment and park may be used for the purposes provided by this act shall be taken into consideration. If an open cut for a railway incline is constructed in any part of the embankment or park, and if the damage to any parcel of real estate bordering thereon occasioned by the use of the embankment or park for such open cut and incline and any surface connection therewith exceeds the value of the benefit or advantage which will result to such parcel from the establishment of the embankment and park, as provided by said chapter four hundred and sixty-five, as amended by said chapter four hundred and two, the amount of such excess shall be determined and may be recovered in the manner hereinbefore provided by this section. In such case no betterment shall be assessed or collected against such parcel under the provisions of section twelve of said chapter four hundred and sixty-five, as amended by section four of said chapter four hundred and two.

SECTION 9. The commission may order the temporary removal or relocation of any surface tracks, and the temporary or permanent removal or relocation of any conduits, pipes, wires, poles or other property of any person or corporation which it deems to interfere with the construction or operation of the subway, and shall grant new locations for any such structures so removed or relocated. Such orders, to the extent specified therein, shall be deemed a revocation of the right or license to maintain such tracks, conduits, pipes, wires, poles or other property, and the owner of any such structures in public ways or lands shall comply with such orders without expense to the city. If such owner shall fail to comply with the order of the commission within a reasonable time, to be fixed in the order, the commission may discontinue and remove such tracks, conduits, pipes, wires, poles or other property, and may relocate the same, and the cost of such discontinuance, removal or relocation shall be repaid to the city by the owner. No such discontinuance, removal or relocation shall entitle the owner of the property thus affected to any damages on account thereof. Any such structures in or upon private lands may be removed and relocated by the commission, or if removed and relocated by the owner thereof, the reasonable expense shall be repaid to him by the commission. Any gas or electric lighting company may shut off the gas or current from any pipes or wires affected by any acts done hereunder, when and so far as may be necessary to avoid danger of escape or explosion of gas or other public danger.

SECTION 10. Before beginning the work of construction the commission shall execute with the company, in the name of the city, the company consenting thereto, a contract in writing for the sole and exclusive use of the subway by the company, for the running of its cars therein and for other purposes, for a term of twenty-five years from the beginning of the use thereof, at an annual rental equal to four and one half per cent of the net cost thereof, and upon such other provisions and conditions, not affecting the term or rental, and following the form of the tunnel lease made by and between the commission and the company December twenty-fourth, nineteen hundred and four so far as the same may be applicable, as the commission and the company may agree upon, or in case of difference as the board of railroad commissioners, hereinafter called the board, may determine. The provisions of this act, in so far as they declare, define or establish the terms and conditions for the construction, tenure, maintenance and operation of the subway, shall be embodied in and made part of said contract. The use of the subway shall begin when, in the opinion of the commission, a reasonable time after completion has been allowed for equipment. The net cost thereof shall be deemed to include, except as herein otherwise provided, all expenditures incurred in acquisition and construction including damages, expenses and salaries of the commission, and interest at three and one fourth per cent per annum on the debt incurred in construction prior to the beginning of the use.

The company may for the purposes of this act, including all equipment or other expenditure by the company required or authorized hereby, from time to time in the manner and subject to the requirements prescribed by law, issue and dispose of such amounts of its capital stock or bonds, at its option, in addition to the amounts heretofore authorized, as may be necessary therefor.

In respect to the equipment, use and operation of the railway to be located in the subway, and transportation thereon, the company shall have all the powers and privileges and be subject to all the duties, liabilities, restrictions and provisions set forth in general and special laws now or hereafter in force applicable to it, so far as the same do not impair contract rights or privileges acquired under any law or otherwise.

The use and control of the subway if acquired by the company shall be subject to the rights, if any, which the West End Street Railway Company may have under the provisions of article two of its lease to the company, dated December nine, eighteen hundred and ninety-seven, or otherwise.

SECTION 11. The transit commission and the Charles river basin commission shall jointly determine, or in case of difference the board shall determine, the amount if any by which the cost of the embankment and park mentioned in section one of this act, and of the conduit, drains or other structures therein or appurtenant thereto, is or may be reduced by reason or in consequence of the work provided for by this act, below the amount which they otherwise would have cost; and the amount of such reduction shall be deducted from the cost of the subway for the purpose of ascertaining the rental thereof. So much of such reduction as may be connected with the cost of construction of the marginal conduit to be constructed by the Charles river basin commission shall be added to the cost of the construction of the metropolitan park system to be assessed under the provisions of section nine of chapter four hundred and sixty-five of the acts of the year nineteen hundred and three, as amended by section two of chapter four hundred and two of the acts of the year nineteen hundred and six, and in determining the amount to be assessed upon and paid by the city under the provisions of said chapter four hundred and sixty-five as so amended, such estimated amount of the reduction connected with the construction of said conduit shall be credited as having been paid by the city. So much of such reduction of cost of the embankment and park as may not be connected with the cost of construction of said marginal conduit shall be borrowed by the city in connection with and in the same manner as the amount which it is to borrow for repaying to the Commonwealth the cost of said embankment and park as provided by section nine of said chapter four hundred and sixty-five, as so amended, and the amount thereof shall be paid into the sinking fund set aside to meet the bonds issued by the city to pay the cost of construction of the subway herein authorized.

SECTION 12. Upon the determination by the transit commission or the Charles river basin commission, either alone or jointly, of any important question arising in the course of the work herein provided for upon which the company has previously requested a hearing, except an award of or agreement upon damages as provided in section eight hereof, the company may within three days after notice of such determination apply to the board for a revision of the same, and thereupon the board may consider and finally determine such question.

SECTION 13. The treasurer of the city shall from time to time, on request of the commission, issue and sell at public or private sale the bonds of the city, registered or with interest coupons attached, as he may deem best, to an amount not exceeding the cost of the subway herein provided for. Such bonds shall be designated on their face, Boston Riverbank Subway Loan, shall be for such terms, not exceeding fifty years, as the mayor and treasurer of the city may determine, and shall bear interest payable semi-annually at such rate not exceeding four per cent per annum, as the treasurer shall determine. The debts incurred by the city from time to time under the provisions of this act shall not be included in determining the limit of indebtedness of the city as established by law, and the proceeds of such bonds shall be used to meet all damages, costs and expenses incurred by the commission or by the city in carrying out the provisions of this act. The board of commissioners of sinking funds shall establish a sinking fund for the payment of the bonds issued under this act. All premiums received from the sale thereof shall be paid into the sinking fund. All rents, tolls, percentages or other annual compensation received by the city for any use of the subway under this act, or for any use of any lands or rights taken under authority of this act, shall annually be used by the treasurer, first, to meet the requirements of any deficiency in the sinking fund; second, to meet the interest on the bonds; and the surplus, if any, as a part of the general revenue of the city. The proceeds from any sale or lease of lands or rights taken by purchase or otherwise under authority of this act shall be paid into the sinking fund, or shall be used for construction, as the commission may determine.

SECTION 14. If the term of the commission expires before the completion of the work herein provided for, the city shall have all the rights, powers and privileges, and be subject to all the duties, restrictions and liabilities, hereby conferred or imposed upon the commission in respect thereto, and such powers and duties shall be exercised and performed by the mayor, city engineer and city treasurer in place of the commission.

SECTION 15. The supreme judicial court and the superior court, upon application of any party in interest, including the company, the city, or any ten taxable inhabitants thereof, may enforce or prevent violation of the provisions of this act by any appropriate process.

SECTION 16. The construction of the subway herein authorized shall be begun at such time after the expiration of one year from the completion of the tunnel authorized by said chapter five hundred and thirty-four as the commission and the company may agree upon, or in case of difference as the board shall determine that the public interests require; but the same may be begun at any time which the commission and the company may agree upon.

SECTION 17. Upon the acceptance of this act by the company the authority granted by chapter five hundred and thirty-four of the acts of the year nineteen hundred and two for the construction of the subway in said chapter five hundred and thirty-four provided for shall cease, but the contract entered into under date of September twenty-fifth in the year nineteen hundred and two between the city of Boston, acting by the commission, and the company shall remain in full force so far as regards the system of tunnels and appurtenances authorized by said chapter five hundred and thirty-four.

SECTION 18. This act shall take effect upon its acceptance by the company, by vote of its board of directors and return thereof, within two months after its passage. [*Approved June* 28, 1907.

APPENDIX B.

[Chapter 247.]

AN ACT TO PROVIDE FOR AN INVESTIGATION OF CONGESTION OF TRAFFIC IN THE STREETS OF THE CITY OF BOSTON.

Be it enacted, etc., as follows:

SECTION 1. The Boston transit commission, when an appropriation sufficient to meet the expenses of such an investigation has been made by the city government, shall investigate the congestion and delay of teaming traffic and of the movement of freight within the city of Boston, and shall consider whether such congestion and delay can be relieved by the construction of subways for the transfer of freight, and shall report its conclusions and recommendations to the general court not later than January tenth, nineteen hundred and eight.

SECTION 2. This act shall take effect upon its passage. [*Approved March 28,* 1907.

APPENDIX C.

[Chapter 258.]

AN ACT TO INCREASE THE AUTHORITY OF THE BOSTON TRANSIT COMMISSION TO TAKE BY EMINENT DOMAIN EASEMENTS OR OTHER ESTATES OR RIGHTS IN REAL ESTATE.

Be it enacted, etc., as follows:

SECTION 1. Section six of chapter five hundred and thirty-four of the acts of the year nineteen hundred and two, being "An Act to provide for the construction of additional tunnels and subways in the city of Boston", is hereby amended by inserting after the word "horizontal", in the fourteenth line, the words:—or inclined,—and by inserting after the word "division", in the fifteenth line, the words:—or by other surfaces,—so as to read as follows:—*Section* 6. The commission may for the purposes of this act use public ways and lands without compensation therefor, and may take for the city, by purchase or otherwise, lands in fee and easements, estates and rights in land, including the right to go under the surface thereof or through or under buildings or parts of buildings thereon, and such takings in fee or otherwise may be made whether the lands taken or otherwise affected are held under or by title derived under eminent domain or otherwise. A taking under this section of an easement or other estate or right in a given parcel of real estate, whether such parcel consists of unimproved land or of land and buildings, may be confined to a portion or section of such parcel fixed by horizontal or inclined planes of division or by other surfaces below or above or at the surface of the soil, and in such case no taking need be made of upper or lower portions or sections, except of such easements therein, if any, as the commission may deem necessary. The commission, to make any taking by right of eminent domain, shall cause to be recorded in the registry of deeds for the county of Suffolk a description of the lands, easements, estates or rights to be taken, as certain as is required in a common conveyance of land, with the statement that the same are taken under authority of this act, which description and statement shall be signed by the commission; and the lands, easements, estates or rights therein described shall upon such recording be taken for and shall vest in the city. The commission shall, so far as may be practicable, notify all known owners of such takings, but the validity thereof shall not be affected by want of such notice.

SECTION 2. This act shall take effect upon its passage. [*Approved March* 29, 1907.

APPENDIX D.

The names of all the assistants in the Engineering Department who have been employed for more than one month during the last year, together with an indication of the work on which they have been engaged, are given below. Those marked * left the employ of the Commission during the year.

OFFICE ASSISTANTS, JUNE 30, 1907.

Assistant Engineers.

EDMUND S. DAVIS,	Oversight of office and field work.
WILLIAM W. LEWIS,	Studies, preliminary estimates, designs for structures and contract plans.
WILLIAM O. WELLINGTON,	
RALPH H. STEARNS,	
LEONARD B. HOWE,	
GEORGE H. STEARNS,	Designs for steel work† and concrete structures.
RUSSELL L. ELLIOT,	
CHARLES H. BARTLETT,	
*AUSTIN M. EVERETT,	
CHAUNCY R. PERRY,	
JOHN S. HODGSON,	Specifications, estimates, etc.

Draughtsmen, etc.

WILBUR W. DAVIS,	Plans for tunnel work and structures.
EDMUND A. RICE,	
GEORGE P. GOODMAN,	
SAMUEL C. LYMAN,	Details for steel work.
EDWIN L. REED,	Station entrances and exits and changes in buildings.
FREDERICK F. MURPHY,	Rodman; tracing, etc.
FREDERIC W. STILES,	Photographer and assistant for purchasing supplies.

PIPE CHANGES.

LAURENCE B. MANLEY,	Assistant Engineer; field and office work.
JOHN J. HURLEY,	Laying out and inspecting work in streets.
*WM. H. BELL,	Rodmen, tracing, etc.
CLARENCE E. EBERT,	

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† The details for reinforced concrete construction of Entrances and Exits at Old South Meeting House and Hayward Place were made in the office of Joseph R. Worcester, Consulting Engineer.

FIELD ASSISTANTS.

G. Dana Emerson,	Assistant Engineer, Section 7.†
Patrick F. O'Brien,	Assistant Engineer, Sections 5 and 9.
Robert B. Farwell,	Assistant Engineer, Sections 6, 8, 10, 11
Charles P. Loveland,	Transitman.
James T. Frame,	Transitman.
James B. Flaws, Ralph C. McPherson,	Assistant transitmen on line and grade work.
*Daniel S. Bell, Hyman Leftovith,	Rodmen on line and grade work.
C. Leonard Brown, Austin E. Joyce, Roy C. Aiken, Arthur E. Lucy,	Transitmen whose duties have largely been inspecting construction work under the supervision of the assistant engineer on the ground.
Moses L. Brown, *Alex. Ellis, Jr., Frederic W. Fletcher, *John T. Tobin, Charles J. Rycroft, *Leo B. Reilly, Peter J. Raftus, Frank W. Burnham, Raymond D. Fales,	Rodmen whose duties have largely been inspecting construction work under the supervision of the assistant engineer on the ground.
Thomas H. Keenan,	Messenger.
*Paul Swartz, Frank H. Schoenfuss,	Testing cement, pitch and other material; also superintending making of concrete sheeting, etc.
Averill D. Carlisle,	Assistant cement tester.
A. W. Parker,	Inspector of steel work.

CLERK, STENOGRAPHERS, ETC.

Arthur B. Carter,	Clerk and stenographer.
Rose A. McMahon,	Stenographer.
*Walter F. Coppinger,	Messenger.
David J. Donahue,	Messenger and Stenographer.
Joseph P. Sheerin,	Messenger and Stenographer.
Michael J. Pendergast,	Messenger and Stenographer.
Charles E. Fay,	Messenger in draughting-room; blue-printing; care of plans.

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† Has also made designs for structures.

APPENDIX E.

WASHINGTON STREET TUNNEL.

CANVASS OF BIDS FOR MAKING CHANGES IN BUILDINGS NOS. 12 TO 18 LA GRANGE STREET, OVER TUNNEL ENTRANCE.

BIDS OPENED JULY 10, 1906.

BIDDERS AND ADDRESSES.	AMOUNTS.
David L. Rand, 166 Devonshire St., Boston	$3,355.00
John Y. Mainland, 166 Devonshire St., Boston	2,985.00
Cahill Construction Co., 7 Water St., Boston	1,970.00
Martin Flynn, 64 Aspinwall Ave., Brookline	1,700.00

NOTE.—The contract was awarded to Martin Flynn.

APPENDIX F.

WASHINGTON STREET TUNNEL.—CANVASS OF BIDS FOR FURNISHING STEEL AND IRON WORK FOR PART OF SECTION 10.

BIDS OPENED AUGUST 2, 1906.

BIDDERS AND ADDRESSES.		150,000 lbs. Structural Steel.	5,000 lbs. Cast Iron.	TOTALS.	TIME NAMED FOR DELIVERY.
American Bridge Co., 89 State St., Boston	Price per lb.	$.0382	$.023		
	Amount.	5,730.00	115.00	$5,845.00	Dec. 1, 1906
Belmont Iron Works, Washington Ave., Philadelphia	Price per lb.	.0375	.026		
	Amount.	5,625.00	130.00	5,755.00	Dec. 1, 1906
Eastern Bridge and Structural Co., Station A, Worcester	Price per lb.	.035	.025		
	Amount.	5,250.00	125.00	5,375.00	Oct. 1, 1906
Lewis F. Shoemaker Co., 712 Harrison Building, Philadelphia	Price per lb.	.0345	.0345		
	Amount.	5,175.00	172.50	5,347.50	Dec. 15, 1906
N. E. Structural Co., 110 State St., Boston	Price per lb.	.0346	.03		
	Amount.	5,190.00	150.00	5,340.00	Oct. 1, 1906

NOTE.—The contract was awarded to New England Structural Company.

APPENDIX G.

WASHINGTON-STREET TUNNEL.—CANVASS OF BIDS FOR CONSTRUCTION OF PART OF SECTION 10.—BIDS OPENED AUGUST 7, 1906.

BIDDERS AND ADDRESSES.	10,000 Cu. Yds. Earth Excavation.	Removing and Disposing of 10 Cu. Yds. Masonry in Cellar Floors, Walls, etc., excepting that included in Items (bh) and (3b).	Removing and Disposing of 50 Cu. Yds. Concrete Masonry from Existing Subway, excepting that included in Item (3b.)	Removing and Disposing of all Concrete in Roof of Existing Subway in area for New Beams, from Beam No. 5 to Beam No. 25, inclusive.	Furnishing and Placing 1,200 Cu. Yds. Concrete Masonry for all purposes, excepting that included in Item (cc).	Furnishing and Placing around Steel Beams, etc. 600 Cu Yds. Concrete Masonry.	Furnishing and Laying with Portland Cement Mortar 20 Cu. Yds. of Brick Masonry.	Laying 300 Lin. Ft. of 12-In. Vitrified Pipe furnished by the Commission.	Laying 40 Lin. Ft. of 6-In., 8-In. and 10-In. Vitrified Pipe furnished by the Commission.	Setting in Place and Securing 20 Tons of Steel and Iron Weighing Less than 6 Lbs. Per Lin. Ft.	Setting in Place and Securing 275 Tons of Steel and Iron Weighing 6 Lbs. or More Per Lin. Ft.	Furnishing, Preparing and Applying 2,000 Sq. Yds. of Portland Cement Mortar ½ In. thick.	Furnishing, Preparing and Applying 1,500 Sq. Yds. of Waterproof Coating, ½ In. Thick, of Pitch or Asphalt.	Preparing and Applying 14,000 Sq. Yds of Tarred Felt, Pitch, etc., furnished by the Commission.	Underpinning, Supporting and Protecting Buildings, etc., and for all other Work and Risks not Covered by other Items.	TOTALS.
	a	b	bb	3b	c	cc	d	ee	3e	f	ff	g	h	i	k	
Jas. J. Coughlan Constr. Co., 104 Hanover St., Boston..	$5.25 52,500.00	$15.00 150.00	$25.00 1,250.00	2,000.00	$13.00 15,600.00	$15.00 9,000.00	$20.00 400.00	$2.00 600.00	$2.00 80.00	$18.00 360.00	$20.00 5,500.00	$.50 1,000.00	$.40 600.00	$.40 5,600.00	$1,300.00	$95,940.00
Charles R. Gow Co., 79 Milk St., Boston. . . .	5.00 50,000.00	10.00 100.00	50.00 2,500.00	2,250.00	13.00 15,600.00	16.00 9,600.00	20.00 400.00	1.00 300.00	1.00 40.00	20.00 400.00	20.00 5,500.00	.50 1,000.00	1.00 1,500.00	.35 4,900.00	1,000.00	95,090.00
Patrick McGovern, 6 Beacon St., Boston......	5.00 50,000.00	5.00 50.00	25.00 1,250.00	2,600.00	11.00 13,200.00	15.00 9,000.00	18.00 360.00	.50 150.00	.50 20.00	15.00 300.00	15.00 4,125.00	.40 800.00	.30 450.00	.30 4,200.00	1,500.00	88,005.00
Hugh Nawn Contracting Co., 82 Savin St., Roxbury....	5.00 50,000.00	5.00 50.00	20.00 1,000.00	1,000.00	12.00 14,400.00	15.00 9,000.00	15.00 300.00	1.00 300.00	1.00 40.00	12.00 240.00	15.00 4,125.00	.60 1,200.00	.30 450.00	.30 4,200.00	1,000.00	87,305.00
Bruno, Salomone & Petitti, 23 Court St., Boston......	4.25 42,500.00	10.00 100.00	15.00 750.00	5,000.00	11.00 13,200.00	13.00 7,800.00	20.00 400.00	.50 150.00	.50 20.00	18.00 360.00	16.00 4,400.00	.50 1,000.00	.75 1,125.00	.50 7,000.00	3,000.00	86,805.00
Coleman Brothers, 15 Court Sq., Boston........	4.50 45,000.00	10.00 100.00	20.00 1,000.00	2,000.00	10.00 12,000.00	15.00 9,000.00	20.00 400.00	.80 240.00	.40 16.00	15.00 300.00	20.00 5,500.00	.50 1,000.00	1.00 1,500.00	.20 2,800.00	4,000.00	84,856.00

NOTE.—The Contract was awarded to Coleman Bros.

APPENDIX H.

Washington Street Tunnel.—Canvass of Bids for About 300 Tons Square Twisted Steel Rods.—Bids Opened September 25, 1906.

Bidders and Addresses.		4,250 lbs. ½″ in 24′ Lengths.	6,640 lbs. ⅝″ in 24′ Lengths.	9,565 lbs. ¾″ in 24′ Lengths.	180,000 lbs. ⅞″ in 16′ Lengths.	400,000 lbs. ⅞″ in 28′ Lengths.	Added Items.	Totals.	Kind of Steel.	Time Named for Delivery.
Fitz, Dana & Co., 110 North St., Boston....	Price per lb. Amount.	$.02 85.00	$.02 132.80	$.02 191.30	$.02 3,600.00	$.02 8,000.00	... .	$12,009.10	....	Shipment to start in one week; complete in 30 days.
James W. Sederquist, 8 Oliver St., Boston.... ..	Price per lb. Amount.	.0199 84.57	.0199 132.14	.0199 190.34	.0199 3,832.00	.0199 7,960.00	. . . .	11,949.05	Either Bessemer or Open Hearth, at option of Mill.	Start in 4 weeks; end in 10 weeks.
Harrington, Robinson Co., 272–276 Franklin St., Boston.......... ..	Price per lb. Amount.	.021 89.25	.02 132.80	.0195 186.52	.0195 3,510.00	.0195 7,800.00	... . .	11,718.57	High Carbon Bessemer.	4 weeks.
United Concrete Machinery Co., 949 Broadway, New York............	Price per lb. Amount.	.01875 79.68	.01775 117.86	.01725 165.00	.01725 3,105.00	.01725 6,900.00	Add $3.30 per ton for freight from Mill, also cartage charge of 75c. per ton, $1,215.92	11,583.46	. . . . .	Shipment to start on or before Oct. 10; complete by Nov. 15.
Fred A. Houdlette & Son, 93 Broad St., Boston........	Price per lb. Amount.	.0205 87.13	.02 132.80	.01925 184.13	.01925 3,465.00	.01925 7,700.00	....	11,569.06	Soft Bessemer, as used for structural.	Begin in 3 or 4 weeks and continue until closed.
Jones, Laugblin Steel Co., 131 State St., Boston..........	Price per lb. Amount.	.02105 85.65	.01965 130.48	.01865 178.39	.01865 3,557.00	.01865 7,460.00	Estimate cost of carting from cars to 75 Canal St., $225.17.	11,436.68	Bessemer.	Could begin in about 3 weeks and complete in about 8 weeks, but could not be responsible for delivery.
Buffalo Steel Co., Tonawanda, N. Y.....	Price per lb. Amount.	.02105 85.64	.01915 127.16	.01865 178.39	.01865 3,357.00	.01865 7,460.00	Estimate cost of carting from cars to 75 Canal St., $225.17.	11,433.36	High Carbon, Elastic limit 50,000 lbs. or higher.	Mentioned.
W. H. Perry Co., 47–49 Stillings St., Boston.... .	Price per lb. Amount.	.0202 85.85	.0197 130.81	.0189 180.78	.0189 3,402.00	.0189 7,560.00	....	11,359.44	. . . . .	Shipment to start in 2 or 3 weeks, complete in 6 to 8 weeks.
Ransome Concrete Machinery Co., 6 Beacon St., Boston.............	Pric per lb. Amount.	.0199 84.58	.0193 128.15	.01865 178.59	.01865 3,357.00	.01865 7,460.00	....	11,208.12	Bessemer or Open Hearth.	For Bessemer 4 to 7 weeks; for Open Hearth 3 to 5 weeks.
Aberthaw Construction Co., 8 Beacon St., Boston.............	Price per lb. Amount.	.0206 87.55	.0196 130.14	.0186 177.91	.0186 3,348.00	.0186 7,440.00	....	11,183.60	Bessemer.	½″ 10 days. ⅝″ 3 weeks. ¾″ 3 " ⅞″ 3 "

Note.—The contract was awarded to Aberthaw Construction Co.

APPENDIX I.

WASHINGTON STREET TUNNEL.—CANVASS OF BIDS FOR CONSTRUCTION OF ENTRANCE AND EXIT AT ESSEX STREET.
BIDS OPENED OCTOBER 23, 1906.

BIDDERS AND ADDRESSES.	450 Cu. Yards Earth Excavation.	Furnishing and Putting in Place, Below Street Floor Level, 270 Cu. Yds. Concrete.	Furnishing and Putting in Place, Above Street Floor Level, 85 Cu. Yds. Concrete.	Setting in Place and Securing 10 Tons of Steel and Iron Weighing Less Than 6 Lbs. per Lin. Ft.	Setting in Place and Securing 15 Tons of Steel and Iron Weighing 6 Lbs. or More per Lin. Ft.	Removing Foundations, Walls, Floors or Other Parts of Present Structures Which Occupy the Space Required for New Work, the Gross Sum of	Preparing and Applying to Structures 1,200 Sq. Yds. of Tarred Felt, Pitch, etc.	Supporting and Protecting Buildings, etc., the Gross Sum of	Furnishing and Setting Curbs, Building Granolithic Sidewalk, etc., the Gross Sum of	TOTALS.	TIME NAMED FOR COMPLETION.
	a	b	c	d	e	f	g	k	m		
Coleman Bros., 15 Court Sq., Boston..........	$6.50 2,925.00	$17.00 4,590.00	$20.00 1,700.00	$20.00 200.00	$25.00 375.00	$1,500.00	$1.00 1,200.00	$5,000.00	$1,500.00	$18,990.00	Jan. 20, 1907.
Falvey & Kelly, 15 Intervale Park, Dorchester	6.00 2,700.00	12.00 3,240.00	20.00 1,700.00	20.00 200.00	20.00 300.00	500.00	.20 240.00	3,000.00	500.00	12,380.00	Mar. 20, 1907.
Hugh Nawn Contg. Co., 82 Savin St., Roxbury	5.00 2,250.00	10.00 2,700.00	11.00 935.00	12.00 120.00	15.00 225.00	5.00	.30 360.00	3,000.00	1,000.00	10,595.00	Mar. 31, 1907.

NOTE.—The contract was awarded to Hugh Nawn Contracting Co.

APPENDIX J.

WASHINGTON STREET TUNNEL.—CANVASS OF BIDS FOR CONSTRUCTION OF ENTRANCE IN ADAMS SQUARE.—BIDS OPENED OCTOBER 23, 1906.

BIDDERS AND ADDRESSES.	1,400 Cu. Yards Earth Excavation.	Removing and Disposing of 100 Cu. Yds. of Masonry, Consisting of Cellar Floors, Walls, Foundations, etc.	Removing and Disposing of 10 Cu. Yds. Concrete Masonry from Existing Subway.	Furnishing, Hauling and Putting in Place 550 Cu. Yds. Concrete.	Furnishing and Laying 20 Cu. Yds. Brick Masonry for Piers for Water Pipes.	Setting in Place and Securing 12 Tons of Steel and Iron Weighing Less than 6 Lbs. per Lin. Ft.	Furnishing, Preparing and Applying to Joints or other Parts of Structure 500 Sq Yds. of Coating, or Skin, of Portland Cement Mortar.	Preparing and Applying to Structure 100 Sq. Yds. of One Mopping of Waterproof Coating of Pitch or Asphalt.	Preparing and Applying to Structures 4,000 Sq Yds. of Tarred Felt, etc.	Underpinning Buildings on Easterly Side of Washington Street; Supporting and Protecting all Buildings and Structures on the Line of the Work, etc.; the Gross Sum of	Handling, Setting in Place and Supporting 100 Lin. Ft of 24″ Cast-iron Water Pipe.	Handling, Setting in Place and Supporting 90 Lin. Ft. of 12″ Cast-iron Water Pipe.	Furnishing and Laying 60 Sq. Yds. of Brick Sidewalk.	Setting in Place 100 Lin. Ft. Granite Curbing.	TOTALS.	TIME NAMED FOR COMPLETION.
	a	b	bb	c	d	f	g	h	i	k	l	ll	m	mm		
Falvey & Kelly,	$6.00	$8.00	$20.00	$12.50	$20.00	$20.00	$.60	$.60	$.20		$2.00	$2.00	$1.50	$.50		
15 Intervale Park, Dorchester....	8,400.00	800.00	200.00	6,875.00	400.00	240.00	300.00	60.00	800.00	8,000.00	200.00	180.00	90.00	50.00	$26,595.00	Mar. 1, 1907.
Coleman Bros.,	6.00	10.00	30.00	16.00	20.00	20.00	.50	.50	.20		3.00	2.00	1.50	.25		
15 Court Sq., Boston........	8,400.00	1,000.00	300.00	8,800.00	400.00	240.00	250.00	50.00	800.00	4,765.00	300.00	180.00	90.00	25.00	25,600.00	Jan. 23, 1907.
Patrick McGovern,	6.00	10.00	25.00	14.00	20.00	20.00	.75	.50	.30		5.00	4.00	1.50	.50		
6 Beacon St., Boston........	8,400.00	1,000.00	250.00	7,700.00	400.00	240.00	375.00	50.00	1,200.00	4,000.00	500.00	360.00	90.00	50.00	24,615.00	Feb. 1, 1907.

NOTE.—The contract was awarded to Patrick McGovern.

APPENDIX K.

WASHINGTON STREET TUNNEL.—CANVASS OF BIDS FOR CONSTRUCTION OF PART OF SECTION 11.—BIDS OPENED NOVEMBER 8, 1906.

BIDDERS AND ADDRESSES.	300 Cu. Yds. Earth Excavation.	Removing and Disposing of 270 Cu. Yds. of Concrete Masonry from Existing Subway.	Furnishing, Hauling and putting in place for all Purposes except that included in Item (cc), 100 Cu. Yds. Concrete made with Portland Cement Mortar.	Furnishing, Hauling and putting in Place around Steel Beams, etc., 150 Cu. Yds Concrete made with Portland Cement Mortar.	Furnishing and Laying 2 Cu. Yds. of Brick Masonry made with Portland Cement Mortar.	Setting in Place and Securing 5 Tons of Steel and Iron Weighing Less than 6 Lbs. per Lin. Ft.	Setting in Place and Securing 120 Tons of Steel and Iron, including needle beams and posts, Weighing 6 Lbs. or more per Lin. Ft.	Furnishing, Preparing and Applying to Joints or other parts of Structures 400 Sq. Yds. of Coating or Skin of Portland Cement Mortar.	Furnishing, Preparing and Applying to Structures 100 Sq. Yds. of Waterproof Coating of Pitch or Asphalt.	Preparing and Applying to Structures 1500 Sq. Yds. of Tarred Felt, Pitch, etc.	Protecting the Relief Station and other Structures near the work, Repairing or Rebuilding Injured Portions of Structures, etc., the gross sum of	TOTALS.	TIME NAMED FOR COMPLETION.
	a	b	c	cc	d	f	ff	g	h	i	k		
Falvey & Kelly, 15 Intervale Park, Dorchester .	$6.00 1,800.00	$25.00 6,750.00	$15.00 1,500.00	$20.00 3,000.00	$25.00 50.00	$20.00 100.00	$25.00 3,000.00	$1.00 400.00	$1.00 100.00	$ .25 375.00	$5,000.00	$22,075.00	Mar. 1, 1907
Jas. J. Coughlan Const'n. Co., 104 Hanover St., Boston	7.00 2,100.00	30.00 8,100.00	13.00 1,300.00	17.00 2,550.00	20.00 40.00	20.00 100.00	30.00 3,600.00	.75 300.00	.60 60.00	.60 900.00	3,000.00	22,050.00	Jan. 10, 1907
Hugh Nawn Contrg. Co., 82 Savin St., Roxbury	7.00 2,100.00	20.00 5,400.00	12.50 1,250.00	16.00 2,400.00	30.00 60.00	20.00 100.00	50.00 6,000.00	.60 240.00	.30 30.00	.30 450.00	4,000.00	22,030.00	Mar. 1, 1907
Patrick McGovern, 6 Beacon St., Boston	5.00 1,500.00	24.00 6,480.00	12.00 1,200.00	18.00 2,700.00	20.00 40.00	15.00 75.00	25.00 3,000.00	.50 200.00	.60 60.00	.35 525.00	2,000.00	17,780.00	Apr. 1, 1907
Coleman Bros., 15 Court Sq., Boston	4.00 1,200.00	20.00 5,400.00	11.00 1,100.00	15.00 2,250.00	20.00 40.00	15.00 75.00	25.00 3,000.00	.50 200.00	1.00 100.00	.25 375.00	1,000.00	14,740.00	Jan. 15, 1907

NOTE.—The contract was awarded to Coleman Bros.

APPENDIX L.

WASHINGTON STREET TUNNEL.

CANVASS OF BIDS FOR FURNISHING STEEL AND IRON WORK FOR ENTRANCE AT FRANKLIN STREET.—BIDS OPENED NOVEMBER 30, 1906.

BIDDERS AND ADDRESSES.		75,000 lbs. Structural Steel.	3,900 lbs. Cast-Iron.	TOTALS.	Time Named for Delivery.
Lewis F. Shoemaker & Co., 712 Harrison Building, Philadelphia	Price per lb. Amount.	$.038 2,850.00	$.05 195.00	$3,045.00	Feb. 28, 1907
Eastern Bridge and Structural Co., Station A., Worcester	Price per lb. Amount.	.035 2,625.00	.0295 115.05	2,740.05	Feb. 1, 1907
N. E. Structural Co., 110 State St., Boston	Price per lb. Amount.	.034 2,550.00	.04 156.00	2,706.00	Feb. 8, 1907
Belmont Iron Works, Philadelphia	Price per lb. Amount.	.0318 2,385.00	.0318 124.02	2,509.02	Mar. 15, 1907
Boston Bridge Works, 47 Winter St., Boston	Price per lb. Amount.	.0318 2,385.00	.028 109.20	2,494.20	4½ mos. from date of receipt of order.
H. P. Converse & Co., 120 Milk St., Boston	Price per lb. Amount.	.0285 2,137.50	.0275 107.25	2,244.75	Feb. 1, 1907

NOTE.—The contract was awarded to H. P. Converse & Co.

APPENDIX M.

WASHINGTON STREET TUNNEL.—CANVASS OF BIDS FOR CONSTRUCTION OF ENTRANCE AND EXIT AT FRANKLIN STREET.—BIDS OPENED DECEMBER 27, 1906.

BIDDERS AND ADDRESSES.	3,200 Cubic Yards Earth Excavation.	Removing and Disposing of 100 Cubic Yards of Masonry Consisting of Cellar Floors, Walls, Foundations, etc.	Furnishing, Hauling and Putting in Place, for All Purposes Except that Included in Item (cc), 750 Cubic Yards Concrete Made with Portland Cement Mortar.	Furnishing, Hauling and Putting in Place Around Steel Beams, etc., 400 Cubic Yards Concrete Made with Portland Cement Mortar.	Furnishing and Laying 5 Cubic Yards of Brick Masonry Made with Portland Cement Mortar.	Setting in Place and Securing 26 Tons of Steel and Iron Weighing Less Than 6 lbs. per Lin. Ft.	Setting in Place and Securing 40 Tons of Steel and Iron Weighing 6 lbs. or More per Lin. Ft.	Furnishing, Preparing and Applying to Joints or Other Parts of Structure 1,200 Sq. Yds. of Coating or Skin of Portland Cement Mortar.	Furnishing, Preparing and Applying to Structures 10 Sq. Yds. of Waterproof Coating of Pitch or Asphalt ½ Inch Thick.	Preparing and Applying to Structures 8,000 Sq. Yds. of Tarred Felt, Pitch, etc.	Furnishing all Material and Constructing 120 Sq. Ft. of Granolithic Sidewalk with Lights.	Cutting Out and Removing Portions of the Walls, Floors, etc., Except that Included in Item (h), of Present Building; Furnishing and Building in Place All Framing, Blocking and Other New Material Required to Join New Work to Old, etc.	Underpinning, Supporting and Protecting the Buildings and Structures on the Line of the Work, etc.	TOTALS.	TIME NAMED FOR COMPLETION.
	a	b	c	cc	d	f	ff	g	h	i	j	jj	k		
Hugh Nawn Cont'g Co., 82 Savin St., Roxbury.	5.00 16,000.00	$6.00 600.00	$12.00 9,000.00	$14.00 5,600.00	$20.00 100.00	$12.00 312.00	$15.00 600.00	$.75 900.00	$1.00 10.00	$.30 2,400.00	$2.00 240.00	800.00	4,000.00	$40,562.00	Apr. 27, 1907
John E. Palmer, 166 Devonshire St., Boston.	4.90 15,680.00	10.00 1,000.00	11.00 8,250.00	16.00 6,400.00	18.00 90.00	16.00 416.00	19.00 760.00	.50 600.00	1.00 10.00	.40 3,200.00	.50 60.00	1,200.00	2,850.00	$40,516.00	June 1, 1907
Falvey & Kelly, 15 Intervale Park, Dorchester..	5.00 16,000.00	6.50 650.00	12.00 9,000.00	15.00 6,000.00	20.00 100.00	20.00 520.00	20.00 800.00	.50 600.00	1.00 10.00	.25 2,000.00	2.00 240.00	500.00	3,500.00	39,920.00	May 5, 1907
Jas. J. Coughlan Const'n Co., 104 Hanover St., Boston.......	4.00 12,800.00	5.00 500.00	10.00 7,500.00	13.00 5,200.00	18.00 90.00	15.00 390.00	17.00 680.00	.50 600.00	.40 4.00	.40 3,200.00	3.00 360.00	500.00	3,000.00	34,824.00	70 Days
Coleman Bros., 15 Court Sq., Boston..........	4.25 13,600.00	7.00 700.00	10.00 7,500.00	12.00 4,800.00	20.00 100.00	15.00 390.00	20.00 800.00	.50 600.00	1.00 10.00	.25 2,000.00	3.00 360.00	1,000.00	2,500.00	34,360.00	May 1, 1907
Chas. R. Gow Co., 79 Milk St., Boston..	4.25 13,600.00	5.00 500.00	10.00 7,500.00	12.00 4,800.00	20.00 100.00	12.00 312.00	12.00 480.00	.35 420.00	1.00 10.00	.25 2,000.00	2.00 240.00	500.00	1,800.00	32,262.00	Mar. 31, 1907
Patrick McGovern, 6 Beacon St., Boston..........	3.85 12,320.00	5.00 500.00	9.00 6,750.00	10.00 4,000.00	20.00 100.00	12.00 312.00	12.00 480.00	.40 480.00	.50 5.00	.20 1,600.00	2.00 240.00	500.00	1,800.00	29,087.00	Apr. 1, 1907

Note.—The contract was awarded to Patrick McGovern.

APPENDIX N.

WASHINGTON STREET TUNNEL.

Quotations for Furnishing Terra-Cotta Furring, January, 1907.

Bidder.	Price Per Square Foot.			Remarks.
	F. O. B. Cars in Boston.	On Sidewalk.	On Station Platform.	
Fiske & Co., 161 Devonshire St., Boston		$.20–12″ x 12″ .12– 6″ x 12″ .12– 6″ x 12″ Delivered on sidewalk.		Type A } " B } Begin delivery in 6 weeks, and complete within 10 weeks from date of order.
Franks G. Evatt, 101 Tremont St., Boston	$0.049			2″ furring like sample submitted. No time given for delivery.
National Fireproofing Co., Walter M. Evatt, N. E. Mgr., 840–842 Old South Bldg., Boston	0.04	0.0475		States that it would be impracticable to work out types A and B in clay; substitutes a drawing of two kinds, one 1¾″ and the other 1⅜″ outside thickness. No time given for delivery.
Eastern Terra-Cotta Brick and Tile Co., 423 Old South Bldg., Boston	0.04 0.036			2″ and 1½″ thick, 12″ x 12″ like sample submitted. Begin shipments at once on standard size, substantially like plan. Delivery within 2 months from date of order.
Wm. H. Smith, 9 Park St., Boston	0.0325 0.03	.0375 .035	.03⅞ .03⅝	2″ 1½″ } Like sketch submitted. Begin delivery within 3 weeks and complete within 2 months from date of order.
	0.05⅝ 0.05⅛	.06 .055	.06⅛ .05⅝	Type A } " B } Begin delivery in 4 weeks, and complete in 2½ months from date of order.

Note.—The contract was awarded to Wm. H. Smith; delivery to be either on station platform or on sidewalk, as may be directed by the Engineer.

APPENDIX O.

WASHINGTON STREET TUNNEL.

Canvass of Bids for Furnishing Steel and Iron Work for Entrance and Exit at Temple Place.

Bids Opened January 22, 1907.

Bidders and Addresses.		99,000 lbs. Structural Steel.	160 lbs. Cast-Iron.	Totals.	Time Named for Delivery.
Fred A. Houdlette & Son, 93 Broad St., Boston	Price per lb.	.036	.02875		Probably March 1, 1907, but not guaranteed on that date.
	Amount.	$3,564.00	$4.60	$3,568.60	
American Bridge Co. of N. Y., 89 State St., Boston	Price per lb.	.0334	.044		Four or Five Months from date of Order.
	Amount.	3,306.60	7.04	3,313.64	
Lewis F. Shoemaker & Co., 712 Harrison Bldg., Philadelphia	Price per lb.	.0328	.0328		March 1, 1907, if 24″ beams are still in stock when award is made.
	Amount.	3,247.20	5.25	3,252.45	
N. E. Structural Co., 110 State St., Boston	Price per lb.	.032	.032		March 1, 1907.
	Amount.	3,168.00	5.12	3,173.12	

Note.—The contract was awarded to New England Structural Company.

APPENDIX P.

WASHINGTON STREET TUNNEL.—CANVASS OF BIDS FOR FURNISHING STRUCTURAL STEEL FOR ENTRANCES AND EXITS NEAR THE OLD SOUTH MEETING HOUSE.—BIDS OPENED JANUARY 24, 1907.

BIDDERS AND ADDRESSES.		50,000 Lbs. Structural Steel.	Totals.	Time Named for Delivery.
Fred A. Houdlette & Son, 93 Broad St., Boston.	Price per lb. Amount.	$.04 2,000.00	$2,000.00	Six weeks from award of Contract.
Eastern Bridge and Structural Co., Sta. A., Worcester.	Price per lb. Amount.	.036 1,800.00	1,800.00	8 weeks.
Boston Bridge Works (Inc.) 47 Winter St., Boston.	Price per lb. Amount.	.0331 1,655.00	1,655.00	4 months from date of receipt of order.
N. E. Structural Co., 110 State St., Boston.	Price per lb. Amount.	.036 1,800.00	1,800.00	March 1, 1907.

NOTE.—The contract was awarded to New England Structural Company.

APPENDIX Q.

WASHINGTON STREET TUNNEL.—CANVASS OF BIDS FOR CONSTRUCTION OF ENTRANCES AND EXITS NEAR THE OLD SOUTH MEETING HOUSE.—BIDS OPENED FEBRUARY 5, 1907.

BIDDERS AND ADDRESSES.	2,000 Cu. Yds. of Earth Excavation.	Removing and Disposing of 5 Cu. Yds. of Masonry, Consisting of Cellar Floors, Walls, Foundations, etc.	Furnishing, Hauling and Putting in Place for all Purposes other than Item (cc) 960 Cu. Yds. of Portland Concrete.	Furnishing, Hauling and Putting in Place around Steel Beams, etc., 90 Cu. Yds. of Portland Concrete.	Furnishing and Laying 2 Cu. Yds. of Portland Brick Masonry.	Setting in Place and Securing 24 Tons of Steel and Iron Weighing Less than 6 Lbs. per Lin. Ft.	Setting in Place and Securing 25 Tons of Steel and Iron Weighing 6 Lbs. or more per Lin. Ft.	Furnishing, Preparing and Applying 100 Sq. Yds. of Coating. or Skin, of Portland Cement Mortar.	Furnishing, Preparing and Applying 100 Sq. Yds. of Waterproof Coating of Pitch or Asphalt.	Preparing and Applying to Structures 1,500 Sq. Yds. of Tarred Felt, Pitch, etc.	Underpinning and Supporting and Protecting Buildings and Structures, and Work and Risks not otherwise covered.	Furnishing, Hauling and Putting in Place 8 Cu. Yds of Cinder Concrete, of 1 part Portland Cement, 3 Sand, 8 Cinders.	TOTALS.	TIME NAMED FOR COMPLETION.
	a	b	c	cc	d	f	ff	g	h	i	k	m		
Charles F. Hall, 73 Fairview Ave., Malden......	$5.95 11,900.00	$6.00 30.00	$16.00 15,360.00	$30.00 2,700.00	$20.00 40.00	$20.00 480.00	$18.00 450.00	$.60 60.00	$.50 50.00	$.30 450.00	$52,000.00	$12.00 96.00	$83,616.00	June 15, 1907.
W. A. & H. A. Root, 16 Devonshire St., Boston.....	4.75 9,500.00	5.00 25.00	9.75 9,360.00	16.87 1,518.30	20.20 40.40	19.75 474.00	12.90 322.50	.73 73.00	.47 47.00	.39 585.00	15,319.00	6.50 52.00	37,316.20	July 1, 1907.
Falvey & Kelley, 15 Intervale Pk., Dorchester...	4.25 8,500.00	5.00 25.00	12.00 11,520.00	25.00 2,250.00	20.00 40.00	20.00 480.00	20.00 500 00	1.00 100.00	.60 60.00	.25 375.00	10,000.00	10.00 80.00	33,930.00	May 25, 1907.
Jas. J. Coughlan Constr. Co., 104 Hanover St., Boston......	5.50 11,000.00	7.00 35.00	16.50 15,840.00	16.50 1,485.00	20.00 40.00	16.00 384.00	19.00 475.00	.40 40.00	.40 40.00	.40 600.00	2,500.00	10.00 80.00	32,519.00	....
Bruno, Salomone & Petitti, 23 Court St., Boston..........	4.80 9,600.00	10.00 50.00	11.50 11,040.00	13.00 1,170.00	20.00 40.00	18.00 432.00	18.00 450.00	.50 50.00	.50 50.00	.25 375.00	3,000.00	10.00 80.00	26,337.00	June 1, 1907.
John E. Palmer, 166 Devonshire St., Boston....	4.30 8,600.00	10.00 50.00	10.00 9,600.00	19.00 1,710.00	20.00 40.00	14.00 336.00	16.00 400.00	.50 50.00	1.00 100.00	.30 450.00	2,800.00	8.00 64.00	24,200.00	June 1, 1907.
Geo. M. Bryne Co., 7 Water St., Boston...........	4.00 8,000.00	5.00 25.00	11.00 10,560.00	12.00 1,080.00	20.00 40.00	15.00 360.00	15.00 375.00	.40 40 00	.40 40.00	.25 375.00	3,000.00	6.00 48.00	23,943.00	....
Patrick McGovern, 6 Beacon St., Boston.........	4.50 9,000.00	10.00 50.00	10.50 10,080.00	12.00 1,080.00	20.00 40.00	14.00 336.00	18.00 450 00	40 40.00	.50 50.00	.30 450.00	2,200.00	7.00 56.00	23,832.00	May 10, 1907.
Metropolitan Contrg. Co., 95 Milk St., Boston...........	3.75 7,500.00	5.00 25.00	9.50 9,120.00	14.00 1,260.00	16.00 32.00	20.00 480.00	20.00 500.00	.40 40.00	.60 60.00	.35 525.00	3,500 00	10.00 80.00	23,122.00	May 1, 1907.
Hugh Nawn Contrg. Co., 82 Savin St., Roxbury	4.25 8,500.00	5.00 25.00	9.00 8,640.00	15.00 1,350.00	18.00 36.00	12.00 288.00	12.00 300.00	.50 50.00	1.00 100.00	.25 375.00	3,000.00	5.00 40.00	22,704.00	May 1, 1907.
Coleman Bros., 15 Court Sq., Boston........	3.25 6,500.00	10.00 50.00	10.00 9,600.00	15.00 1,350.00	20.00 40.00	12.00 288.00	20.00 500.00	.50 50.00	.75 75.00	.25 375.00	1,700.00	8.00 64.00	20,592.00	May 15, 1907.

NOTE.—The contract was awarded to Coleman Bros.

APPENDIX R.

WASHINGTON STREET TUNNEL.

Canvass of Bids for Furnishing Steel and Iron Work for Section 6.—Bids Opened February 26, 1907.

Bidders and Addresses.		38,800 lbs. Steel Tie-Rods, over 2 inches in diameter.	2030 lbs. Steel Turnbuckles and Clevises.	323,000 lbs. Structural Steel.	4,750 lbs. Cast Steel.	1,900 lbs. Cast-Iron.	Totals.	Time Named for Delivery (1907) of Three Instalments defined in specifications.
Lewis F. Shoemaker & Co., 712 Harrison Building, Philadelphia	Price per lb. Amount.	$.049 1,901.20	$.049 99.47	$.049 15,827.00	$.049 232.75	$.049 93.10	$18,153.52	1st. July 1. 2nd. July 15. 3rd. July 31.
American Bridge Co., 89 State Street, Boston	Price per lb. Amount.	.0318 1,233.84	.096 194.88	.0368 11,886.40	.0695 330.13	.0575 109.25	13,754.50	1st. June 15. 2nd. June 15. 3rd. June 15.
Eastern Bridge & Struct. Co., Station A., Worcester.	Price per lb. Amount.	.035 1,358.00	.10 203.00	.0363 11,724.90	.075 356.25	.0275 52.25	13,694.40	1st. April 25. 2nd. May 23. 3rd. May 23.
New England Structural Co., 110 State St., Boston	Price per lb. Amount.	.04 1,552.00	.07 142.10	.033 10,659.00	.05 237.50	.03 57.00	12,647.60	1st. June 1. 2nd. June 15. 3rd. July 1.

Note.—The contract was awarded to Eastern Bridge and Structural Company.

APPENDIX S.

Washington Street Tunnel.—Canvass of Bids for Construction of Section 6, Near the Old State House.—Bids Opened April 4, 1907.

																	Underpinning Items.			
Bidders and Addresses.	22,000 Cub. Yds. Earth Excavation.	Removing and Disposing of 800 Cub. Yds. of Concrete and other Masonry.	Furnishing, Hauling and Putting in Place, for all Purposes other than Item (cc), 6,300 Cub. Yds. of Portland Concrete.	Furnishing, Hauling and Putting in Place Around Steel Beams, etc., 200 Cub. Yds. of Portland Concrete.	Furnishing and Laying 30 Cub. Yds. of Portland Brick Masonry.	Laying 600 Feet of 12″ and 15″ Vitrified Pipe, Furnished by the Commission.	Laying 400 Feet of 4″, 6″ and 8″ Vitrified Pipe, Furnished by the Commission.	Setting in Place and Securing 225 Tons of Steel and Iron Weighing Less than 6 Pounds per Linear Foot.	Setting in Place and Securing 200 Tons of Steel and Iron Weighing 6 Pounds or More per Linear Foot.	Furnishing, Preparing and Applying 4,000 Sq. Yds. of Coating, or Skin, of Portland Cement Mortar.	Furnishing, Preparing and Applying 1,000 Sq. Yds. of Waterproof Coating of Pitch or Asphalt.	Preparing and Applying to Structures 25,000 Sq. Yds. of Tarred Felt, Pitch, etc.	Furnishing, etc., 110 Sq. Yds. Granolithic Sidewalk with Lights, Complete.	Cutting Out and Removing Old State House Floors, Walls, etc., not Included in Item (b), and other Work.	Totals Without Items for Underpinning.	Underpinning and Supporting Buildings, etc., the Sears Building to be Underpinned with Masonry.	Underpinning and Supporting Buildings, etc., the Sears Building *not* to be Underpinned with Masonry.	Totals if Sears Building is Underpinned with Masonry, (as Item kk).	Totals if Sears Building is Not Underpinned with Masonry (as Item kkk).
	a	b	c	cc	d	e	ee	f	ff	g	h	i	j	jj		kk	kkk		
Jones & Meehan, 10 Tremont St., Boston. .	$6.00 132,000.00	$8.00 6,400.00	$12.00 75.600.00	$14.00 2,800.00	$20.00 600.00	$1.00 600.00	$1.00 400.00	$15.00 3,375.00	$20.00 4,000.00	$.50 2,000.00	$1.00 1,000.00	$.50 12,500.00	$2.00 220.00	2,000.00	$243,495.00	$54,000.00	$50,000.00	$297,495.00	$293,495.00
T. J. O'Connell, 158 Adams St., Dorchester	5.00 110.000.00	20.00 16,000.00	11.50 72,450.00	16.00 3,200.00	16.00 480.00	1.00 600.00	1.00 400.00	15.00 3,375.00	18.00 3,600.00	.50 2,000.00	.50 500.00	.25 6,250.00	2.00 220.00	5,000.00	224,075.00	40,000.00	35,000.00	264,075.00	259,075.00
Chas. F. Taylor & Co., 913 Tremont Bdg.,Boston	5.00 110,000.00	8.00 6,400.00	12.00 75,600.00	15.00 3,000.00	25.00 750.00	2.00 1,200.00	1.00 400.00	20.00 4,500.00	25.00 5,000.00	.75 3,000.00	.50 500.00	.30 7,500.00	5.00 550.00	1,000.00	219,400.00	35,000.00	27,000.00	254,400.00	246,400.00
Hugh Nawn Contracting Co., 82 Savin St., Roxbury. . . .	5.00 110,000.00	10.00 8,000.00	10.00 63,000.00	15.00 3,000.00	20.00 600.00	1.00 600.00	1.00 400.00	12.00 2,700.00	15.00 3,000.00	.50 2,000.00	.30 300.00	.25 6,250.00	2.00 220.00	2,500.00	202,570.00	35,000.00	23,000.00	237,570 00	225,570.00
Metr. Contracting Co., 95 Milk St., Boston.	4.35 95,700.00	12.00 9,600.00	11.00 69,300.00	15.00 3,000.00	18.00 540.00	.50 300.00	.50 200.00	12.00 2,700.00	20.00 4,000.00	.40 1,600.00	.90 900.00	.25 6,250.00	18.00 1,980.00	1,500.00	197,570.00	25,000.00	19,000.00	222,570.00	216,570.00
Coughlan & Sheils Co., 104 Hanover St., Boston. .	3.80 83,600.00	9.90 7,920.00	10.25 64,575.00	11.00 2,200.00	18.00 540.00	.50 300.00	.50 200.00	13.00 2,925.00	13.00 2,600.00	.45 1,800.00	.50 500.00	.23 5,750.00	18.00 1,980.00	900.00	175,790.00	26,850.00	21,550.00	202,640.00	197,340.00
Coleman Bros., 15 Court Sq., Boston.	3.50 77,000.00	15.00 12,000.00	10.00 63,000.00	15.00 3,000.00	25.00 750.00	1.00 600.00	.50 200.00	12.00 2,700.00	20.00 4.000.00	.50 2,000.00	.60 600.00	.20 5,000.00	4.00 440.00	2,000.00	173,290.00	20,000.00	15,000.00	193,290.00	188,290.00
Patrick McGovern, 6 Beacon St., Boston.	3.80 83,600.00	18.50 14,800.00	9.50 59,850.00	11.00 2,200.00	16.00 480.00	.60 360.00	.10 40.00	8.00 1,800.00	10.00 2,000.00	.25 1,000.00	.25 250.00	.20 5,000.00	2.00 220.00	500.00	172,100.00	15,235.00	10,835.00	187,335.00	182,935.00

Note.—The contract was awarded to Patrick McGovern.

APPENDIX T.

WASHINGTON STREET TUNNEL.—CANVASS OF BIDS FOR CONSTRUCTION OF ENTRANCE AND EXIT AT TEMPLE PLACE.—BIDS OPENED APRIL 23, 1907.

BIDDERS AND ADDRESSES.	400 Cu. Yds. of Earth Excavation.	Removing and Disposing of 50 Cu. Yds. Masonry in Cellar Floors, Foundations, etc.	Furnishing, Hauling and Putting in Place, for all Purposes other than Item (cc), 150 Cu. Yds. of Portland Concrete.	Furnishing, Hauling and Putting in Place, in 12″ Walls, Stairways, Around Steel Beams, etc., 220 Cu. Yds. of Portland Concrete.	Furnishing and Laying 2 Cu. Yds. of Portland Brick Masonry.	Setting in Place and Securing 5 Tons of Steel and Iron Weighing Less than 5 Pounds per Linear Foot.	Setting in Place and Securing 50 Tons of Steel and Iron Weighing 6 Pounds or More per Linear Foot.	Furnishing, Preparing and Applying 250 Sq. Yds. of Coating, or Skin, of Portland Cement Mortar.	Furnishing, Preparing and Applying 250 Sq. Yds. of Waterproof Coating of Pitch or Asphalt.	Preparing and Applying to Structures 1,200 Sq. Yds. of Tarred Felt, Pitch, etc.	Furnishing, etc., 30 Sq. Yds. of Granolithic Sidewalk with Lights, Complete.	Cutting Out and Removing Floors, Walls, etc., of Present Buildings, Except Included in Item (h), Joining New Work to Old, and Finishing in Detail.	Underpinning and Supporting and Protecting Buildings, and for all other Work and Risks not Covered by other Items.	TOTALS.	TIME NAMED FOR COMPLETION.
	a	b	c	cc	d	f	ff	g	h	i	j	jj	k		
Hugh Nawn Contracting Co.,	$5.00	$10.00	$15.00	$15.00	$20.00	$12.00	$15.00	$.75	$.50	$.30	$22.00				
82 Savin St., Roxbury....	2,000.00	500.00	2,250.00	3,300.00	40.00	60.00	750.00	187.50	125.00	360.00	660.00	3,000.00	$2,000.00	15,233.50	Sept. 1, 1907
Coughlan & Sheils Co.,	6.50	9.00	16.00	16.00	20.00	16.00	22.00	.50	.50	.35	18.00				
104 Hanover St., Boston..	2,600.00	450.00	2,400.00	3,520.00	40.00	80.00	1,100.00	125.00	125.00	420.00	540.00	500.00	1,000.00	12,900.00	Three months.
Coleman Bros.,	5.00	10.00	11.50	15.00	20.00	20.00	20.00	.50	.70	.25	17.00				
15 Court Sq., Boston.....	2,000.00	500.00	1,725.00	3,300.00	40.00	100.00	1,000.00	125.00	175.00	300.00	510.00	900.00	700.00	11,375.00	July 30, 1907
T. J. O'Connell,	4.50	15.00	12.00	15.00	15.00	10.00	15.00	.50	.30	.25	5.00				
158 Adams St., Dorchester.	1,800.00	750.00	1,800.00	3,300.00	30.00	50.00	750.00	125.00	75.00	300.00	150.00	500.00	1,500.00	11,130.00	July 1, 1907
John E. Palmer,	3.80	7.00	10.00	15.00	20.00	12.00	16.00	.50	1.00	.30	17.00				
79 Journal Bdg., Boston...	1,520.00	350.00	1,500.00	3,300.00	40.00	60.00	800.00	125.00	250.00	360.00	510.00	1,350.00	400.00	10,565.00	July 15, 1907

NOTE.—The contract was awarded to John E. Palmer.

APPENDIX U.

WASHINGTON STREET TUNNEL.—CANVASS OF BIDS FOR FURNISHING STEEL AND IRON WORK FOR ENTRANCE AND EXIT AT WINTER STREET.—BIDS OPENED APRIL 25, 1907.

BIDDERS AND ADDRESSES.		33,360 Lbs. Steel Tie-rods with Nuts and Washers.	1,220 Lbs. Steel Sleeve-nuts.	122,200 Lbs. Structural Steel.	200 Lbs. Cast Iron.	TOTALS.
Belmont Iron Works, 22nd St. and Washington Ave., Philadelphia, Pa....	Price per lb.	$.034	$.09	$.041	$.04	
	Amount.	1,134.24	109.80	5,010.20	8.00	$6,262.24
Lewis F. Shoemaker & Co., 712 Harrison Building, Philadelphia, Pa....	Price per lb.	.034	.16	.0399	.034	
	Amount.	1,134.24	195.20	4,875.78	6.80	6,212.02
New England Structural Co., 100 State Street, Boston...........	Price per lb.	.0355	.08	.0355	.03	
	Amount.	1,184.28	97.60	4,338.10	6.00	5,625.98

NOTE.—A modified contract, amounting to $3,766.00, was awarded to New England Structural Company, May 27, 1907.

APPENDIX V.

WASHINGTON STREET TUNNEL.

CANVASS OF BIDS FOR FURNISHING STEEL AND IRON WORK FOR ENTRANCE AND EXIT AT BOYLSTON STREET.

BIDS OPENED APRIL 26, 1907.

BIDDERS AND ADDRESSES.		12,000 lbs. Structural Steel.	325 lbs. Cast-Iron.	Totals.
New England Structural Co.,	Price			
110 State St.,	per lb.	$.0425	$.04	
Boston	Amount	510.00	13.00	$523.00
Boston Bridge Works., Inc.,	Price			
47 Winter Street,	per lb.	.0375	.0325	
Boston	Amount	450.00	10.56	460.56
Eastern Bridge & Structural Co.,	Price			
Station A.,	per lb.	.03$\frac{2}{3}$	.0275	
Worcester, Mass	Amount	440.00	8.94	448.94

NOTE.—The contract was awarded to Boston Bridge Works, Inc.

APPENDIX W.

WASHINGTON STREET TUNNEL.

CANVASS OF BIDS FOR FURNISHING STEEL AND IRON WORK FOR ENTRANCE AND EXIT AT HAYWARD PLACE.

BIDS OPENED MAY 16, 1907.

BIDDERS AND ADDRESSES.		68,000 lbs. Structural Steel.	2,000 lbs. Cast-Iron.	TOTALS.
Lewis F. Shoemaker & Co., 712 Harrison Building, Philadelphia	Price per lb.	$.039	$.039	
	Amount	2,652.00	78.00	$2,730.00
New England Structural Co., 110 State St., Boston	Price per lb.	.03⅛	.03	
	Amount	2,125.00	60.00	2,185.00

NOTE.—The contract was awarded to New England Structural Company.

APPENDIX X.

Washington Street Tunnel.—Canvass of Bids for Construction of Entrance and Exit at Boylston Street.—Bids Opened May 16, 1907.

Bidders and Addresses.	1,500 Cubic Yards Earth Excavation.	Removing and Disposing of 130 Cu. Yds. of Masonry in Cellar Floors, Foundations, etc., Other than Included in Item (bb).	Removing and Disposing of 100 Cu Yds. of Concrete Masonry from Tunnel Structure, and from Underpinning.	Furnishing, Hauling and Putting in Place, for all Purposes other than Item (cc), 530 Cu. Yds. Portland Concrete	Furnishing, Hauling and Putting in Place, in Stairs and in 12-Inch Walls and Floors and Around Beams, etc., 200 Cu Yds. Portland Concrete.	Furnishing and Laying 25 Cu. Yds. of Portland Brick Masonry.	Laying 60 Lin. Ft. of 24-inch Vitrified Pipe, Furnished by the Commission	Laying 10 Lin. Ft. of 8-inch and 10-inch Vitrified Pipe, Furnished by the Commission.	Setting in Place and Securing 8 Tons of Steel and Iron Weighing Less than 6 Pounds per Linear Foot.	Setting in Place and Securing 20 Tons of Steel and Iron Weighing 6 Pounds or More per Linear Foot.	Cutting Out and Removing 12 Tons of Steel and Iron.	Furnishing, Preparing and Applying 300 Sq. Yds. of Coating, or Skin, of Portland Cement Mortar.	Furnishing, Preparing and Applying 100 Sq. Yds. of Waterproof Coating of Pitch or Asphalt.	Preparing and Applying to Structures 4,000 Sq. Yds. of Tarred Felt, Pitch, etc.	Furnishing, etc., 65 Sq Yds. of Granolithic Sidewalk with Lights, Complete.	Cutting Out and Removing Floors, Walls, etc., of Present Building, Other than Items (b) and (bb) and Finishing in Detail.	Underpinning and Supporting and Protecting Buildings, and for all Other Work and Risks not Covered by Other Items.	Totals.	Time Named for Completion.
	a	b	bb	c	cc	d	e	ee	f	ff	3f	g	h	i	j	jj	k		
John E. Palmer, 79 Journal Bldg., Boston.	$4.90 7,350.00	$10.00 1,300.00	$22.00 2,200.00	$10.50 5,565.00	$18.00 3,600.00	$18.00 450.00	$1.50 90.00	$.50 5.00	$12.00 96.00	$16.00 320.00	$15.00 180.00	$.50 150.00	$.25 25.00	$.25 1,000.00	$17.00 1,105.00	$3,000.00	$1,800.00	$28,236.00	Nov. 1, 1907
Woodbury & Leighton Co., 166 Devonshire St., Boston.	5.25 7,875.00	6.00 780.00	20.00 2,000.00	9.00 4,770.00	20.00 4,000.00	20.00 500.00	.25 15.00	.10 1.00	12.00 96.00	17.00 340.00	25.00 300.00	.50 150.00	.90 90.00	.20 800.00	18.00 1,170.00	1,920.00	3,200.00	28,007.00	Sept. 1, 1907
Charles F. Hall, 17 Milk St., Boston.	4.50 6,750.00	8.00 1,040.00	12.00 1,200.00	10.00 5,300.00	15.50 3,100.00	20.00 500.00	1.75 105.00	1.00 10.00	16.00 128.00	18.50 370.00	14.00 168.00	.50 150.00	.70 70.00	.30 1,200.00	34.00 2,210.00	2,275.00	1,700.00	26,276.00	——
Patrick McGovern, 6 Beacon St., Boston	5.00 7,500.00	5.00 650.00	18.00 1,800.00	10.50 5,565.00	15.00 3,000.00	20.00 500.00	1.00 60.00	1.00 10.00	12.00 96.00	16.00 320.00	10.00 120.00	.50 150.00	.40 40.00	.35 1,400.00	15.00 975.00	1,500.00	1,500.00	25,186.00	Sept. 1, 1907
Coughlan & Sheils Co., 104 Hanover St., Boston	4.00 6,000.00	7.00 910.00	15.00 1,500.00	13.00 6,890.00	15.00 3,000.00	18.00 450.00	1.50 90.00	1.00 10.00	11.00 88.00	17.00 340.00	10.00 120.00	.40 120.00	.45 45.00	.25 1,000.00	18.00 1,170.00	1,200.00	1,900.00	24,833.00	Sept. 1, 1907
Chas. R. Gow Co., 79 Milk St., Boston.	4.00 6,000.00	5.00 650.00	20.00 2,000.00	10.00 5,300.00	18.00 3,600.00	18.00 450.00	2.00 120.00	1.00 10.00	12.00 96.00	15.00 300.00	15.00 180.00	.25 75.00	.40 40.00	.30 1,200.00	18.00 1,170.00	1,200.00	1,400.00	23,791.00	Aug. 30, 1907

Note.—The contract was awarded to Chas. R. Gow Co.

APPENDIX Y.

WASHINGTON STREET TUNNEL.—CANVASS OF BIDS FOR CONSTRUCTION OF ENTRANCE AND EXIT AT HAYWARD PLACE.—BIDS OPENED JUNE 20, 1907.

BIDDERS AND ADDRESSES.	230 Cubic Yards Earth Excavation.	Removing and Disposing of 50 Cu. Yds. Masonry in Cellar Floors, Walls, Foundations, etc.	Removing and Disposing of 10 Cu. Yds. of Concrete Masonry from Tunnel Structure.	Furnishing, Hauling and Putting in Place, for All Purposes Other than Item (cc), 300 Cu. Yds. Portland Concrete.	Furnishing, Hauling and Putting in Place, in Stairs and Floors, 12 Inches Thick or Less, and Around Beams, etc., 100 Cu. Yds. Portland Concrete.	Furnishing and Putting in Place 40 Cu. Yds. of Portland Cement Granolithic.	Furnishing and Laying 5 Cu. Yds. of Portland Brick Masonry.	Setting in Place and Securing 7 Tons of Steel and Iron Weighing Less than 6 Pounds per Lin. Ft.	Setting in Place and Securing 35 Tons of Steel and Iron Weighing 6 Pounds or More per Linear Foot.	For Removing, Without Injury from Walls of Present Structure, and Delivering to the Canal-Street Stockyard, 5 Tons Steel and Iron.	Furnishing, Preparing and Applying 250 Sq. Yds. of Coating, or Skin, of Portland Cement Mortar.	Furnishing, Preparing and Applying 20 Sq. Yds. of ½-inch Waterproof Coating of Pitch or Asphalt.	Preparing and Applying to Structures 1,000 Sq. Yds. of Tarred Felt, Pitch, etc., in Layers.	Cutting Out and Removing Floors, Walls, etc., of Present Building, Other than Included in Item (b), and Finishing in Detail.	Underpinning and Supporting and Protecting Buildings, and for all Other Work and Risks Not Covered by Other Items.	TOTALS.	TIME NAMED FOR COMPLETION.	TOTALS, Including Premium at $10 per Day, Dating from Sept. 1, 1907. (See Page 5, Specification.)
	a	b	bb	c	cc	3c	d	f	ff	3f	g	h	i	jj	k			
Coughlan & Sheils Co., 104 Hanover Street, Boston.	$6.00 1,380.00	$9.00 450.00	$25.00 250.00	$13.50 4,050.00	$16.00 1,600.00	$19.00 760.00	$20.00 100.00	$12.00 84.00	$22.00 770.00	$10.00 50.00	$.50 125.00	$.50 10.00	$.30 300.00	$1,500.00	$1,500.00	$12,929.00	Sept. 1, 1907.	$12,929.00
Falvey & Kelly, 15 Intervale Pk., Dorchester.	7.00 1,610.00	7.00 350.00	30.00 300.00	12.00 3,600.00	14.00 1,400.00	28.00 1120.00	25.00 125.00	30.00 210.00	30.00 1,050.00	50.00 250.00	1.00 250.00	.80 16.00	.30 300.00	1,000.00	1,000.00	12,581.00	Sept. 1, 1907.	12,581.00
Chas. F. Hall, 73 Fairview Ave., Malden.	4.40 1,012.00	7.00 350.00	20.00 120.00	10.50 3,150.00	16.00 1,600.00	40.00 1,600.00	20.00 100.00	11.00 77.00	16.50 577.50	11.00 55.00	.50 125.00	.50 10.00	.30 300.00	825.00	600.00	10,501.50	Sept. 30, 1907.	10,791.50
Patrick McGovern, 6 Beacon Street, Boston.	5.00 1,150.00	5.00 250.00	20.00 200.00	11.00 3,300.00	14.00 1,400.00	14.00 560.00	20.00 100.00	12.00 84.00	14.00 490.00	12.00 60.00	.50 125.00	.50 10.00	.30 300.00	950.00	1,000.00	9,979.00	Oct. 1, 1907.	10,279.00
John E. Palmer, 79 Journal Bdg., Boston.	3.80 874.00	6.00 300.00	20.00 200.00	9.70 2,910.00	15.00 1,500.00	20.00 800.00	20.00 100.00	15.00 105.00	20.00 700.00	20.00 100.00	.50 125.00	.30 6.00	.25 250.00	1,050.00	750.00	9,770.00	Oct. 10, 1907.	10,170.00
Chas. R. Gow Co., 79 Milk Street, Boston.	5.00 1,150.00	6.00 300.00	25.00 250.00	10.00 3,000.00	15.00 1,500.00	25.00 1,000.00	20.00 100.00	12.00 84.00	20.00 700.00	15.00 75.00	.40 100.00	.40 8.00	.30 300.00	300.00	1,000.00	9,867.00	Sept. 1, 1907.	9,867.00

NOTE.—The contract was awarded to Chas. R. Gow Co.

APPENDIX Z.

The following principals and agents have furnished steel for the Commission during the year.

NAME.	ADDRESS.
Structural Steel:	
Harrington, Robinson & Co.,	272–276 Franklin St., Boston.
Jones & Laughlin Steel Co.,	131 State St., Boston.
Buffalo Steel Co.,	Tonawanda, N. Y.
Lewis F. Shoemaker & Co.,	Harrison Bldg., Philadelphia, Pa.
American Bridge Co.,	89 State St., Boston.
Eastern Bridge & Structural Co.,	Station A, Worcester, Mass.
New England Structural Co.,	110 State St., Boston.
Boston Bridge Works, Inc.,	47 Winter St., Boston.
Belmont Iron Works,	22nd St. and Washington Ave., Philadelphia, Pa.
James A. Sederquist,	8 Oliver St., Boston.
Fred A. Houdlette & Son,	93 Broad St., Boston.
W. H. Perry Co.,	43–49 Stillings St., Boston.
H. P. Converse & Co.,	120 Milk St., Boston.
Reinforcing Rods:	
Fitz, Dana & Co.,	110 North St., Boston.
United Concrete Machinery Co.,	949 Broadway, New York City.
Ransome Concrete Machinery Co.,	6 Beacon St., Boston.
Aberthaw Construction Co.,	8 Beacon St., Boston.

APPENDIX ZZ.

CAMBRIDGE SUBWAY CONNECTION.

CANVASS OF BIDS FOR BORINGS.
BIDS OPENED JAN. 7, 1907.

Depth of Borings. Lin. Feet.	HEALY SEWER MACHINE AND CONSTRUCTION CO., 15 Beacon Street, Boston.		B. F. SMITH & BROTHER, 38 Oliver Street, Boston.	
	Per Linear Foot.	Total.	Per Linear Foot.	Total.
(A) 4 Borings. 30′ to 50′=160′	$.60	$96.00	$.50	$80.00
(B) 1 to 40 feet.	.50	20.00	.70	28.00
70 "	.70	49.00	.90	63.00
95 "	1.25	118.75	1.25	118.75
100 "	1.25	125.00	1.50	150.00
85 "	1.25	106.25	1.25	106.25
75 "	1.25	93.75	1.25	93.75
45 "	.60	27.00	.50	22.50
55 "	.60	33.00	.65	35.75
	Total,	$668.75	Total,	$698.00

NOTE.—The contract was awarded to B. F. Smith & Brother.